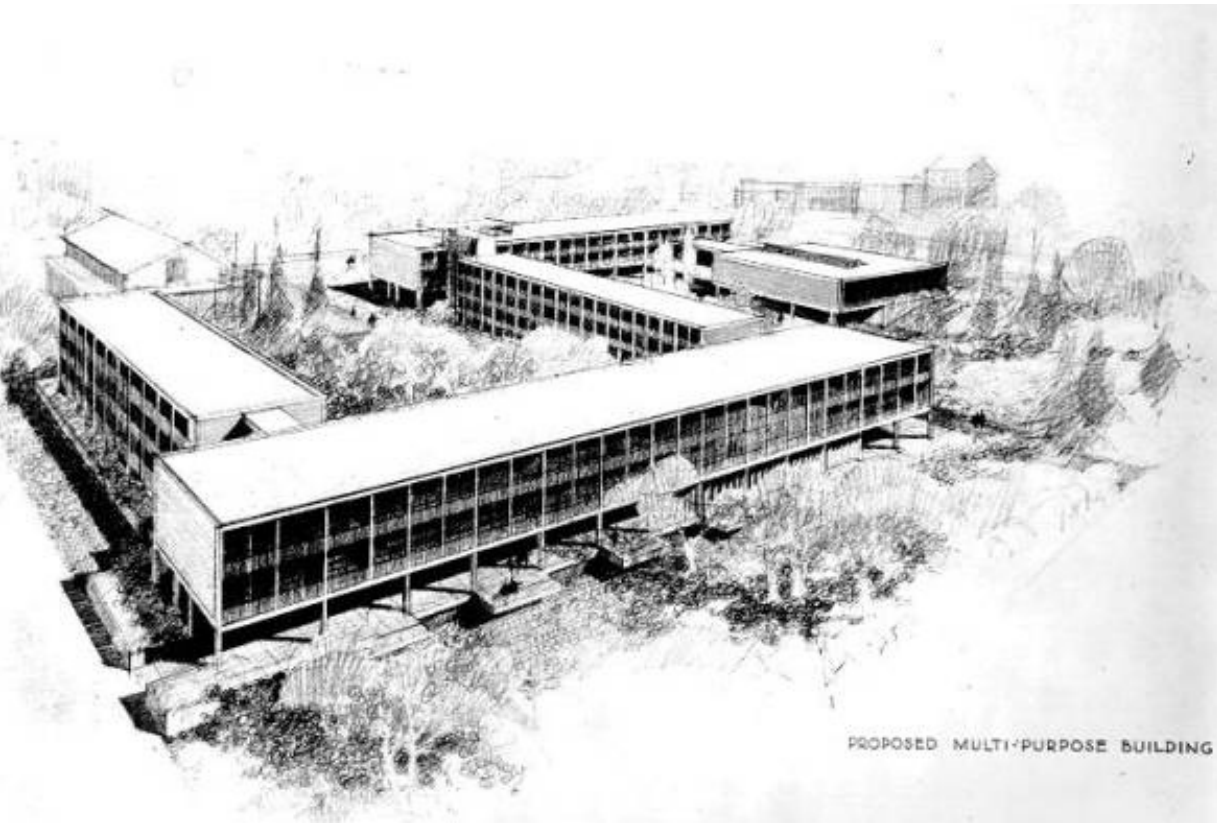
Life Cycle Assessment

Buchanan Building D

July 2006



PREPARED FOR UBC PROJECT SERVICES

AltusHelyar

BUSBY PERKINS + WILL

Life Cycle Assessment

Buchanan Building D

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1. Executive Summary

Greater awareness of the ramified network of the effects of materials and products on the environment has led to an interest in understanding life cycle implications of building design. Together with escalating construction costs and depletion of natural resources, it has become even more pertinent to understand the full cost, financial and environmental, of renovating versus constructing new facilities. Life Cycle Assessment (LCA) is an increasingly significant means of evaluating the environmental impacts of construction materials and is gaining acceptance in the green building field. It is a methodology for assessing the environmental performance of a service, process, or product over all life-cycles, i.e. cradle to grave.

This study comprised a post-mortem (post-design) Life Cycle Assessment and salvaged value cost estimate of the Buchanan Renovation Phase 1 – Building D, located on University of British Columbia campus. Busby Perkins+Will used the Athena™ Environmental Impact Estimator life-cycle analysis tool to model the different schemes, to analyze the avoided environment impacts associated with the retention of building components and to compare the life-cycle implications between the renovation project and a new building scheme that implied demolishing the entire existing construction. These implications, or "summary measures", reviewed in this study are:

- Primary Energy Consumption (MJ)
- Global warming potential (GWP) (CO_2 equivalent)
- Index of Air Pollution Effects
- Index of Water Effects
- Natural Resource use (kg)
- Weighted Resource Use (kg)
- Solid Waste (kg)

It was first found that a significant amount of energy, resource and pollution is embodied within the existing building; the vast majority of the environmental impacts occurring mostly during the manufacturing phase, but also during the construction phase. As a result of retaining as much as possible of Buchanan Building D, and thereby avoiding the manufacturing and construction phases of many new building materials, the overall environmental footprint of the renovation project is considerably reduced. When comparing Total Life Cycle environmental implications, significant volumes of solid waste (147,607 kg), water pollution (index of 314) and resource use (4,460,831 kg) are avoided by retaining and reusing components. An additional 3.5 million litres of water use is embodied within the retained components.

In comparing the Renovation and New Construction schemes, the inclusion of Total Operating Energy consumption became a determining factor since its effect is greatly accentuated by the life-expectancy of the building. For instance, even though the renovation project has substantially lower environmental impacts in three (Solid Waste, Water Pollution Index, Natural Resources) of the six analysed categories, the New Building scheme has a slightly smaller environmental footprint in the other three (Primary Energy Consumption, Air Pollution Index, and Global Warming Potential).

Furthermore, Altus Helyar Cost Consulting estimated an additional cost of $8,472,000 to replace the existing building by a new one. They estimated the salvage value of the retained components to be $7,650,500, equating to approximately $1,500 per square meter.

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This study, finally, provides an in-depth look at the salvaged value, environmental life cycle benefits and ramifications, and the tradeoffs of renovating versus constructing a new building. It helps the University of British Columbia to fully understand the magnitude and scope of up and down stream environmental implications and salvage value of retaining large components of the Buchanan Building D. For the University, the project results in a more cost effective solution and has a comparatively low environmental life cycle impact, particularly with respect to water pollution, resource use, and solid waste.

2. Introduction

2.1. Purpose of the Study

The University of British Columbia, Renew Program engaged Busby Perkins + Will and Altus Helyar Cost Consulting to complete a life cycle assessment and costing analysis of retaining Buchanan Building D. The intent of this analysis is to quantify both the environmental impacts and costs that are avoided by retaining parts of the existing building like the structure, as well to compare the environmental impacts of renovating versus demolishing and constructing a new building.

The project is two fold. Busby Perkins+Will has carried out a life cycle assessment analysis using the Athena Sustainable Materials Institute's (Athena) Environmental Impact Estimator (EIE) tool to quantify the environmental life cycle implications and benefits of retaining Building D. Altus Helyar Cost Consulting has quantified the volume and salvage value of the materials retained in today's dollars.

2.2. Project Description

Buchanan Building D, originally built in 1960 as a multi-purpose classroom addition, is currently being renovated under UBC's Renew Program to accommodate current and future educational needs. Block D consists of 1-level below grade (basement with M&E rooms) and 3-levels above ground with classrooms/student services. The gross floor area of the project, measured in accordance with the Canadian Institute of Quantity Surveyors guidelines is 5,090 square meters

Its structure is made of concrete with pre-cast hollow-core floor and roof slabs. The newly renovated building will serve as the new hub for undergraduate services on campus, providing new class room space, program space for Academic Undergraduate Advising, graduate student offices for the Department of Philosophy, Continuing Education Office, and Arts Undergraduate Society.

The Buchanan Renovation Phase 1 – Building D project principally consists of making the envelope more energy efficient by changing the current single-glazed strip windows to a double-glazed window system and of renovating the interior by replacing the partitions, the ceilings and the floor finishes. Some major mechanical upgrades and new elevator will be added as part of the renovation project. In sum, the majority of the building's structure and superstructure is to remain. This renovation project has a green design goal of LEED®-Gold certification.

3. Overview of Life Cycle Assessment

3.1. Overview of LCA

Conventional design and construction practices have typically produced resource-intensive buildings. Worldwide, the construction industry consumes approximately 3 billion tonnes of raw resources annually, at an unsustainable rate of depletion. Fossil fuel energy is used to extract, refine, manufacture and transport building materials, contributing to global warming. Moreover, the energy required to operate a building over its life span is many times greater than the energy consumed during its construction. However, for other embodied effects such as toxic releases to water, effects during the resource extraction and manufacturing stages greatly outweigh any releases associated with building operations.[1]

In Canada, buildings are major consumers of energy, water, and material resources. More specifically, residential and commercial buildings within the Greater Vancouver area on an annual basis are estimated to:

- Emit 3.6 million tonnes of greenhouse gas, representing 35% of the regional (GVRD) contribution to greenhouse gases.
- Consume 309 million cubic metres of water
- Consume 51 million Gigajoules of electricity
- Consume 64 million Gigajoules of natural gas
- Generate 1.7 million tonnes of demolition, land clearing, and construction materials, 40% of the municipal solid waste stream.[2]

These numbers just begin to quantify the life cycle impact of buildings within the region. There are many opportunities for building owners and designers to lessen a building's life cycle impacts through the careful selection of resource efficient building materials and the integration of green design strategies such as passive design systems which take advantage of natural systems (i.e., daylight and natural ventilation). Building reuse and retrofit is another strategy or approach for building owners to consider as a means of reducing the up- and down-stream impacts of a building. There are, of course, numerous factors to consider when reusing a building such as its overall energy performance, programming issues, historical value, cost, etc.

Life Cycle assessment (LCA), by definition, is a methodology for assessing the environmental performance of a service, process, or product including a building, over its entire life cycle . LCA goes beyond green design guidelines or green building certification programs, by offering a greater in-depth analysis of products and identifying a full spectrum of estimated effects. The quality of an LCA is largely dependent on the quality of life cycle inventory analysis or data sets detailing material flows in and out of the system, such as raw resources, energy by type, water, and emissions to air, water and land.

LCA methodology is still evolving and being refined as more data becomes available on new building materials. Nevertheless, LCA is recognized as an internationally- accepted approach to assessing the comparative environmental attributes of products and processes.

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1. ATHENA Sustainable Materials Institute. What is LCA? www.athenasmi.ca/about/challenge.html
2. Greater Vancouver Regional District (GVRD). 2003. Green Building Design: Principles, Practices & Systems. GVRD.
3. Trusty. W & Horst.S. 2002. Integrating LCA Tools in Green Building Rating Systems. The Austin Papers Best of the 2002 International Green Building Conference. Austin, TX. USA.

Several software tools are available that allow project teams to perform life cycle assessments. The US Department of Commerce National Institute of Standards and Technology BEES (Building for Environmental Sustainability) tool (US) performs life cycle assessments on individual products. The Athena Sustainable Materials Institute's Environmental Impact Estimator (EIE) (Canadian), Envest (UK) and EcoQuantum (Netherlands) are software tools that perform life cycle assessment of whole building systems. Of these whole building life cycle assessment tools, the Athena Environmental Impact Estimator is the only tool applicable to North America. It can be used during the conceptual phase of a project to evaluate whole building system designs; whereas software tools such as BEES compare individual products independent of each other.

As with any new tool or system, there are obstacles and constraints. The greatest and most recognized constraints to LCA are: limited availability of product data and absence of appropriate reference or benchmarks against which to judge LCA results for a particular building.

By understanding the life cycle impacts of a project, design teams and building owners are able to better understand the full environmental effects accrued throughout all life cycle stages (material extraction, manufacture, transportation, construction and end-of-life).

3.2. Overview of Athena™ Environmental Impact Estimator

Based on Busby Perkins+Will's previous experience working with the Athena™ Environmental Impact Estimator (EIE) software tool, this tool was used for this study to quantify the environmental impacts that are avoided by retaining the existing shell for the Building D.

As described above the EIE tool is the only software available in North America that will perform an LCA of an entire building assembly. It is also regionalized; calculations are based on typical practice, energy use and transportation of materials. It currently covers eight specific regions for Canada, three for the U.S., and a U.S. average, and allows users to take account of the embodied effects of material maintenance and replacement over an assumed building life, distinguishing between owner-occupied and rental facilities where relevant.

The Environmental Impact Estimator is a life cycle assessment-based decision support tool which allows the project teams to examine the environmental implications of product selection related to building structure and envelope (i.e., foundations, walls, beams and columns, floor and roofs, and extra items). The tool takes into account the following factors for the modeled project and material assembly:

- material manufacturing, including resource extraction and recycled content;
- related transportation;
- on-site construction;
- regional variation in energy use, transportation, and other factors;
- building type and assumed lifespan (100 years);
- maintenance, repair, and replacement effects;
- demolition and disposal; and
- operating energy emissions and pre-combustion effects.

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Once the project is modeled within the software, the following environmental implications, or summary measures, are generated (see Appendix A for definitions):

- Primary Energy Consumption (MJ)
- Global warming potential (GWP) (CO_2 equivalent)
- Index of Air Pollution Effects
- Index of Water Effects
- Natural Resource use (kg)
- Weighted Resource Use (kg)
- Solid Waste (kg)
- Total Life Cycle Costs Including Operating Energy (Embodied Energy, MJ)

4. Modeling using Athena™ EIE software

4.1. Modeled Assumptions

4.1.1 Models

In order to best assess the complex relations between the environmental impacts of renovating Buchanan Building D in comparison of building a new and similar construction, various models were made:

Model 1 – Full Demolished Building

Model 1 was created in order to estimate the impacts of demolishing the existing building. Only the end-of-life and bill of materials data were extracted for this analysis. These results were added to the environmental impacts of Model 5 – New Building in order to order to quantify the full life cycle impacts of demolishing and constructing a new building.

Model 2 – Demolished Materials

Model 2 quantifies the environmental impacts of the selective demolition. The removed materials comprised aluminum frame glazing system, the majority of interior hollow clay tile partitions along with their stucco finish, and concrete masonry unit interior walls (refer to Section 2.2 Project Description).

The removed materials were modeled so that the resulting data could be added to those of Model 4 – Renovation Work in order to understand the total impact of the renovated building. Only the end-of-life and bill of materials data were used.

Model 3 – Retained Components

The goal of this model was two fold. First this model was used to estimate the avoided environmental impacts of keeping major components of the existing construction as part of the renovated building scheme. For this analysis, only the manufacturing, construction and end-of-life of the remaining construction needed to be accounted for in the calculations of the avoided impacts exercise. A building-life-expectancy of zero years was used which automatically discarded the Operations and Maintenance environmental impacts from the model.

The second purpose of this model was to use the modeled data for a comparison exercise between the Renovated and the New Building schemes. Since the building already exists, only the Operations and Maintenance and the end-of-life results were used for the comparison exercise and an estimated building-life-expectancy of 80 years was used.

The retained components principally consist of the concrete foundation and structure, floor slabs, roof assembly, stairs, and exterior walls.

Model 4 – Renovation Work

This model includes only the new materials of the renovation work and its outputs were added to the overall Renovated Building scheme (as described below) to estimate the reduced environmental impacts of renovating the existing building, as oppose to building new. An estimated building-life-expectancy of 80 years was used. The new added materials mainly include: steel stud interior

partitions and shaft walls with gypsum board both sides with batt insulation within cavities of some of them; concrete masonry unit elevator shaft walls; and exterior aluminum double-glazed window system (refer to Section 2.2 Project Description).

Model 5 – New Building

This model, intended to simulate the construction of a new building that would be an exact replica of the existing building in size and materials, is in fact Model 3 with higher standards of construction. The roof insulation has been upgraded from 25.4mm to 101.6mm. Rigid insulation of 50mm in thickness and vapour-barrier membranes have been added to the concrete slabs-on-grade and the foundation walls. Finally, the level of flyash in concrete has been increased where possible, i.e. in all the footing, foundation walls, the concrete topping and the slabs-on-grade have 35% of flyash content. It is also important to note that the results obtained were combined with those from Model 4 in order to create a complete building. A building-life-expectancy of 80 years was applied to this model.

Summary of Renovation vs. New Building Schemes:

In order to accurately compare a renovated building with a newly constructed building, we were required to combine several of the models listed above to capture the impacts associated with full and selective building demolition.

Renovation Scheme	New Building Scheme
Model 2 (end-of-life plus bill of materials)	Model 1 (end-of-life plus bill of materials)
Model 3 (Operations and Maintenance, End-of-life and Operating energy at 100%	Model 4 (All measures included)
Model 3 (Operations and Maintenance, End-of-life and Operating energy at 100%	Model 5 (All measures included and operating energy at 85%)

4.1.2 Other Assumptions

In addition, a number of modeling assumptions were made, in part because some of the existing building materials were not available in the software database. Below is a list of the modeled assumptions:

- The majority of the interior partitions were constructed with hollow clay tiles. As per the recommendation by Athena™'s representative, the total amount of hollow clay tiles was modeled as "roofing clay tiles" and converted into square meter area;
- In order to take into account the difference in quality between the glazing system installed in 1960 and the new glazing to be installed, the existing glazing system was modeled using Extra Basics Materials as per linear meters of aluminum framing and square meters of single standard glazing while the new strip windows were modeled using the Curtain Wall Type of the Athena database;
- For the concrete structure average column and bay spacings equivalent to the overall span of the existing structure were used; and
- For the renovation model, all the steel studs interior partitions were summarized into two types of envelope definitions: 5/8" Gypsum Board Type-'X' both sides with 89mm batt insulation within cavities and 5/8" Gypsum Board Type-'X' both sides (Note: the software tool only allows two different kinds of envelope definition per type of framing).

4.1.3 Operating Energy Consumption

The Operating Energy Consumption was included in Models 3 and 5 for the comparative exercise between the Renovation and New Building schemes. The Commercial Building Incentive Program (CBIP) Screening Tool, used by Stantec (the Mechanical Engineers on the current renovation project) to assess the energy efficiency and consumption, estimated an overall performance improvement of 16.4% for the Renovated Building when comparing to the existing. It was projected that the annual energy use for the Renovated Building would be 3,652,000 MJ.

The annual operating energy use for the New Building model was estimated at 90% of the annual operating energy use for the Renovated Building, making the new building 26.4% more energy efficient than the existing building, which is equivalent to the CBIP standard of at least 25% lower than the Canadian Model National Energy Code for Buildings (MNECB). This is a conservative estimate for a new building but it provides a point of comparison between the Renovated and New Building schemes.

4.2. Modeling Limitations

One of the major challenges encountered while modeling the existing building was to correctly select comparable materials when the existing materials were not available within the software database. An example of this is described in section 4.1 above where roofing clay tiles were used to model the hollow clay tiles interior partitions. Since there was no hollow clay tile wall type available, the 4" hollow clay tiles were converted into square meter area and an estimated amount of mortar needed to be inputted as Extra Basic Materials.

It is also important to note that the EIE tool only takes into account the construction related to the structure, envelope, partitions and roof assembly of a building. Other components typically related to a building such as site work, equipment, furnishings, and conveying systems are considered of less importance by the Athena™ Sustainable Materials Institute due to their usually smaller environmental impact. As well, only a limited range of wall finishes can be modeled into the EIE tool, which leaves a wide array of finishes unaccounted for, including floor finishes and ceilings. Even the materials and work related to mechanical and electrical, which typically are a major part of the building construction, are not part of the LCA models.

5. Discussion of Results

The following sections provide a summary of the results generated by the various models described above. Section 5.1 first provides a synopsis of the environmental impacts avoid by retaining the Building D structure whereas section 5.2 provides a more detailed comparison of the environmental impacts linked with renovating versus constructing a new building.

5.1. Avoided Environmental Impacts by Retaining Components

When considering the avoided life cycle impacts of retaining Building D, Model 3 demonstrates there are significant benefits associated with salvaging major components of the building:

- 218,919 kg of solid waste was not sent to local landfills or recycling facilities;
- 773,248 kg of CO_2 equivalent emissions were not released into the atmosphere; and
- 12.3 million MJ of primary energy avoided over the manufacturing, construction and end-of-life stages, the equivalent of 300,000 litres of heavy fuel is not consumed.

The vast majority of the Primary Energy is used during the manufacturing process. In fact, when not taking into account the operations and maintenance aspects of a building such as in Table 5.1a, the manufacturing process is then responsible for an even larger part of the environmental impacts of a building, which averages at 92% in Table 5.1a.

Table 5.1a - Model 3 Retained Components total embodied environmental impacts

	Manufacturing	Construction	Operations and Maintenance	End-of-life	Total Embodied	Operating Energy
Primary Energy Consumption (MJ)	10,660,045	1,458,104	n/a	181,007	12,299,156	n/a
Soild Waste (kg)	173,389	44,828	n/a	2	218,219	n/a
Air Pollution Index	132,816	10,813	n/a	85	143,714	n/a
Water Pollution Index	308	0	n/a	0	380	n/a
Global Warming Potential (kg) (CO_2 equivalent)	751,916	20,922	n/a	410	773,248	n/a
Weighted Resource Use (kg)	5,061,135	33,093	n/a	4,107	5,098,335	n/a

Throughout these life-cycle stages, resources such as water, electricity and coal are also consumed to power and facilitate manufacturing and construction processes. Table 5.1b summarizes additional key environmental impacts that are avoided by reusing this structure. For instance, approximately 3.4 million litres of water and over 400,000 kWh of electricity are saved. Moreover, since the use of 62.5 tonnes of coal is avoided, it is fair to conclude that the air and water pollution resulting from this renovation project is notably reduced.

Table 5.1b - Key environmental impacts avoided by retaining components

Materials	Quantity
Electricity Use	411,691 kWh
Water Use	3,431,462 L
Coal Use	62,498 kg

5.2. Comparison of the Renovated Building Scheme to the New Building Scheme

5.2.1 Renovated Building Scheme Results

In order to comprehensively estimate the environmental impacts associated with the renovation of Buchanan Building D, it is important to include each phase of the work.

First, the selective demolition work takes place prior to renovate (model 2). Therefore, only the environmental impacts of the process of demolishing (end-of-life) is taken into account (refer Appendix B Model Results Table 5.2a). Table 5.2b itemizes the amount of materials sent to the landfill, or recycled when possible, as a consequence of this selective demolition process.

Second, the environmental impacts associated with keeping parts of the existing building are considered, i.e. operating and maintaining the existing building over its useful life, and demolishing it at the end of its life (refer to Appendix B Model Results Table 5.2c Model 3). The manufacturing and construction processes are automatically discarded from the calculations since it is already built.

Finally, the impacts from the renovation work are estimated so that they can be added later to the calculations (refer to Appendix B Model Results Table 5.2d Model 4).

Results from these three phases are then compiled into one final table that summarizes the overall environmental impact of renovating the Buchanan Building D (refer to Table 5.2e).

Table 5.2e - Renovated Building Scheme Overall Summary Measures (sum of tables 5.2a, 5.2c, 5.2d)

	Manufacturing	Construction	Operations and Maintenance	End-of-life	Total Embodied	Operating Energy
Primary Energy Consumption (MJ)	1,598,540	57,128	1,213,617	217,208	3,086,493	340,542,878
Soild Waste (kg)	46,555	5,092	16,818	2	68,467	713,294
Air Pollution Index	30,698	203	66,483	102	97,486	8,394,701
Water Pollution Index	87	0	6	0	93	664
Global Warming Potential (kg) (CO_2 equivalent)	114,734	1,182	177,702	490	294,108	17,515,826
Weighted Resource Use (kg)	284,638	1,309	217,102	4,929	507,978	6,307,239

5.2.2. New Building Scheme Results

Similar to the Renovated Building scheme, the estimation of the environmental impacts associated with the construction of the New Building must include each phase of the work.

First, the complete demolition of the existing building takes place. Therefore, only the environmental impacts of the process of demolishing (end-of-life) is taken into account (refer to Appendix B Model Results Table 5.2f). Table 5.2g quantifies the amount of removed materials sent to landfill, or recycled when possible, as a consequence of the demolition process.

Second, the environmental impacts associated with constructing a completely new building are accounted for, i.e. manufacturing all building materials, and constructing, operating, maintaining and demolishing the building (refer to Appendix B Model Results Table 5.2h).

All of these measures are then compiled into one final table summarizing the overall environmental impacts of constructing a completely new building to replace the Buchanan Building D (refer to Table 5.2i).

Table 5.2i - New Building Scheme Overall Summary Measures (sum of tables 5.2f and 5.2h)

	Manufacturing	Construction	Operations and Maintenance	End-of-life	Total Embodied	Operating Energy
Primary Energy Consumption (MJ)	12,789,474	1,527,013	1,253,645	398,891	15,969,023	289,510,358
Soild Waste (kg)	219,481	49,920	17,994	4	287,399	606,402
Air Pollution Index	166,290	11,020	67,228	186	244,724	7,136,701
Water Pollution Index	467	0	6	0	473	565
Global Warming Potential (kg) (CO_2 equivalent)	872,637	22,125	180,179	900	1,075,841	14,890,968
Weighted Resource Use (kg)	5,335,263	34,670	220,504	9,051	5,599,488	5,362,059

5.2.3. Comparison of Renovated and New Bulding Models

This section compares and contrasts the six environmental implications for each building scheme, highlighting the difference between the two models and the potential explanations for these differences. Table 5.2j provides results for each building; the Renovated Building results are shown in green.

Table 5.2j – Comparison Table between Renovated Building versus New Building Scheme

	Manufacturing	Construction	Operations and Maintenance	End-of-life	Total Embodied	Operating Energy	Total Life Cycle
Primary Energy Consumption (MJ)	1,598,540	57,128	1,213,617	217,208	3,086,493	340,542,878	343,629,371
	12,789,474	1,527,013	1,253,645	398,891	15,969,023	306,490,985	322,460,008
Soild Waste (kg)	46,555	5,092	16,818	2	68,467	713,294	781,761
	219,481	49,920	17,994	4	287,399	641,969	929,368
Air Pollution Index	30,698	203	66,843	102	97,486	8,394,701	8,492,187
	166,290	11,020	67,228	186	244,724	7,555,290	7,800,014
Water Pollution Index	87	0	6	0	93	664	757
	467	0	6	0	473	598	1,071
Global Warming Potential (kg) (CO_2 equivalent)	114,734	1,182	177,702	490	294,108	17,515,826	17,809,934
	872,637	22,125	180,179	900	1,075,841	15,764,367	16,840,208
Weighted Resource Use (kg)	284,638	1,309	217,102	4,929	507,978	6,307,239	6,815,217
	5,335,263	34,670	220,504	9,051	5,599,488	5,676,560	11,276,048

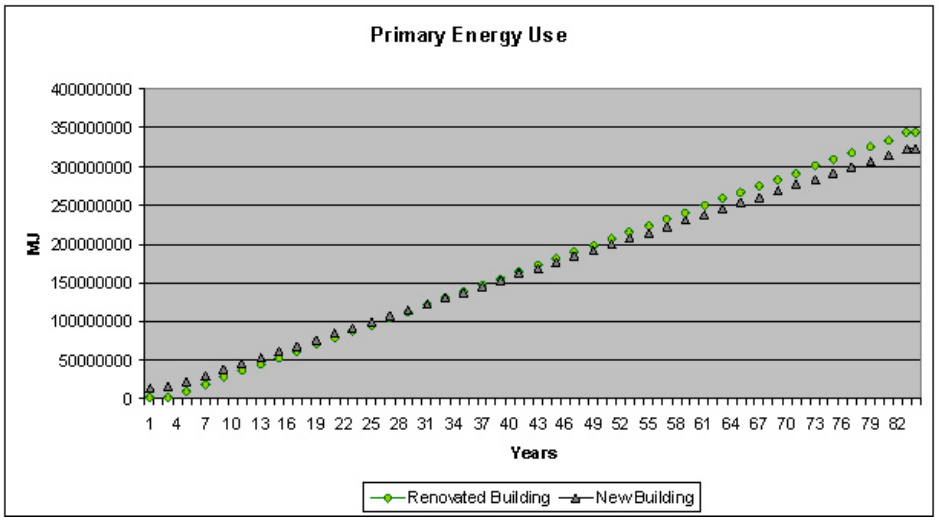
Primary Energy Consumption Analysis

Primary Energy Consumption is essentially embodied primary energy (MJ) and includes all energy, direct and indirect, used to transform or transport raw materials into products and buildings, including inherent energy contained in raw or feedstock materials that are also used a common energy sources (see Appendix A for further description). When comparing the Renovated and New Building schemes, it is apparent that the Renovated Building has less embodied Primary Energy Consumption, principally concentrated during the manufacturing process.

However, when extrapolated over an 80 year life span and with consideration of the operational energy, the New Building will overall consume 6% less primary energy (21 million MJ) than the Renovated Building. This is understandable since the newer, more energy-efficient building requires less resource to operate. In addition, this positive effect on the environment is accentuated when multiplied by the number of years the building is expected to be used.

Chart 1 shows the different consumption profiles for each building scheme and the crossover point, at which point the New Building scheme has a lower primary energy use than the Renovated Building model.

Chart 1 - Primary Energy Use



Solid Waste Analysis

Solid waste is reported on a mass basis in kilograms. This comparison shows that overall the New Building construction will create 19% more solid waste than generated by the Renovated Building. Over the life of the Renovated Building, a total of 147,607kg of solid waste is diverted from local landfills by retaining large components of Building D.

More so, by retaining the concrete structure of Building D over 2,500 m³ of concrete, 10.76 tonnes of steel wire mesh and 138 tonnes of steel reinforcing bars are not removed from the site. A detailed comparison of the materials saved versus those removed from the site as a consequence of

demolishing the existing building is provided in Appendix B. From this summary, it is apparent that the total amount of materials is quite significant when demolishing a whole building rather then a selective demolition process. Up until more recently, most of this material would have been dispose of at local landfills. Today, on average 50% of demolition waste is diverted to reuse and recycling facilities in the Greater Vancouver region. Although recycling facilities provide a favorable alternative to land-filling material, when evaluating the total life cycle impacts, it is critical to consider the energy and other resources required to process diverted materials.

It is important to note that one limitation of the EIE software currently is that it does not take into consideration a material's recyclability and reusability.

Air Pollution Index Analysis

To determine the Air Pollution Index, Athena uses an accepted critical volume method to estimate the volume of ambient air or water that would be required to dilute contaminants to acceptable levels. The Air Pollution Index is a maximum of a given set of air pollutants, divided by 1000. Please refer to Appendix A for more details. When examining the total embodied Air Pollution effects of the two building schemes, the Renovated Building has 2.5 times lower total embodied impact when compared to the New Building.

However, the Total Life Cycle impact highlights that over an 80 year life span, the New Building will emit 8% less air pollutants. This result is mostly likely due to the improved operational performance of a new building.

Water Pollution Index Analysis

The Water Pollution Index is calculated in the same manner as was the Air Pollution Index. Athena uses an accepted critical volume method to estimate the volume of water that would be required to dilute contaminants to acceptable levels. The Water Pollution Index is a maximum of a given set of water pollutants, divided by 1000. Please refer to Appendix A for more details.

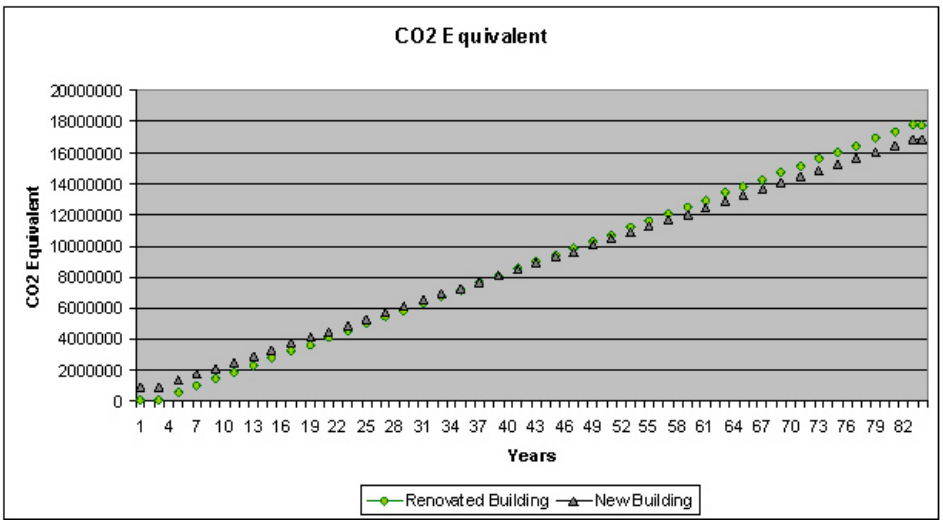
Overall, the New Construction scheme will release approximately 5 times the pollution than the Renovated model during its manufacturing phase only. Moreover, it will release 41% more pollution as compared to the Renovated Building over its total life cycle.

Global Warming Potential Analysis

The Global Warming Potential is a reference measure for all greenhouse gas emissions. Carbon dioxide or "CO_2 equivalent effect" is the common reference standard for global warming or greenhouse gas effects. This equivalency measure accounts for carbon dioxide, methane, and nitrogen oxide.

The Renovated Building scheme has a lower total embodied Global Warming Potential than the New Building model. A total of 781,786 kg CO_2 equivalent emissions are not released into the atmosphere during the upfront life cycle phases, not including operating energy. When the total operating energy is factored into the final life cycle impact for the two models, the New Building model emits 5% (969,671 kg) less CO_2 equivalent emissions overall. This comparison is charted below for both buildings showing the cross over point for emissions released once the building is operational.

Chart 2 - CO_2 Equivalent

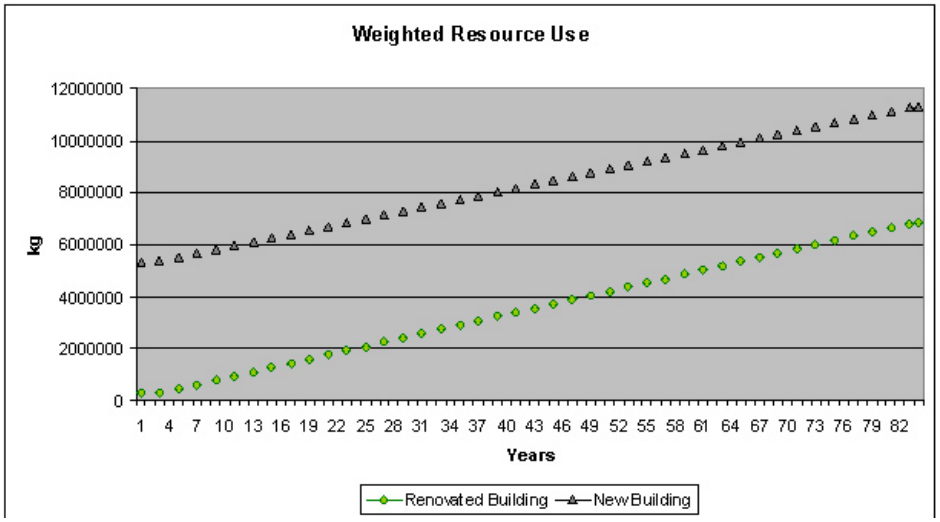


Weighted Resource Analysis

The Weighted Resource Use effect is calculated by the Athena Institute as the sum of weighted resources requirements for all products used in each of the designs. This measure can be thought of as "ecologically weighted kilograms", where the weights reflect expert opinion about the relative ecological carrying capacity of extracting the resources.

The total embodied Weighted Resource Use saved by the Renovation Building equates to 5,091, 151 kg or 11 times less than the New Building scheme. This result is largely due to the amount of materials salvaged and retained for the Renovated Building scheme, Buchanan Building D. In comparing the total life cycle impact, which includes total operating energy, the Renovated Building scheme still consumes 40% less natural resources (overall 4.5 million kg) over its 80 year span.

Chart 3 - Weighted Resource Use



Manufacturing Process versus Total Embodied Environmental Impact Analysis

The manufacturing process accounts for the majority of the embodied environmental impacts. For instance in the New Building scheme, it is responsible for 83% of the total embodied impacts (e.g., 79% for the Primary Energy Use, 76% for Solid Waste, 66% for the Air Pollution Index, 99% for the Water Pollution Index, 80% for the Global Warming Potential, and 95% for the Weighted Resource Use). If the manufacturing of new building materials could be avoided or lessen, either by using a high level of recycled and/or salvaged materials or by retaining existing components, the environmental impacts would be significantly lower.

5.3. Summary of Comparative Analysis

When comparing the two schemes (Table 5.2j), it is apparent that the embodied environmental impacts of demolishing the whole building and constructing new are greater than renovating Building D. The majority of these embodied impacts are seen within the manufacturing and constructing processes. For example, if one only looks at the manufacturing process, constructing a new building has between 5 times (Solid Waste) to 18 times (Weighted Resource Use) more embodied environmental impacts. In addition the New Building scheme has between 6 times (Air Pollution Index) to 25 times (Weighted Resource Use) impact when comparing the data of the construction phase only.

However, when the total operational energy is factored into the total life cycle cost for each model, the gaps between the models become smaller for each environmental implication, particularly for Primary Energy Consumption and Global Warming Potential. This is understandable since the newer, more energy-efficient building requires less resource to operate, consequently less pollution. And this positive effect on the environment is accentuated when multiplied by the building life expectancy.

The only area where the data are similar between the two schemes is in the Operations and Maintenance phase. This is understandable since both schemes are very similar models, one having slightly more materials like rigid insulation (refer to 4.1.1 – Model 5). Moreover, the difference between the schemes in the Operations and Maintenance phase becomes negligible when stretched over the life span of the building. However, one could note that the greatest environmental impact linked to the Operations and Maintenance is air pollution.

Overall the environmental impact ratios for the New Building compared to the Renovated Building over its life span are as follows:

- 6% less primary energy is consumed;
- 19% more solid waste is created;
- 8% less air pollution is emitted;
- 41% more water pollution is emitted;
- 5% less CO_2 equivalent is emitted; and finally
- 65% more natural resource is used.

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Since these are estimated values with a tolerance of few percents, some of them could appear practically similar, like the values for the primary energy consumption and the CO_2 equivalent emissions. However, it should be noted that a small reduction in percentage for a large amount is still considerable, such as in the case of Primary Energy Use with 6% of 343,601,147 MJ equates to more than 20 million Mega Joules.

Often only the decrease in operating energy and subsequently CO_2 emissions reduction are assessed when determining the environmental merits of a building and can overshadow the full embodied effects of a building. Moreover, it should be noted that the solid waste, natural resource use, and water index for the New Building model are front-loaded, occurring mainly during the manufacturing and construction phases as oppose to more constantly distributed over the life-span of the building. Therefore, it is equally important to consider these environmental impacts when evaluating the total life cycle impact of a building.

6. Salvaged Value Estimate

6.1. Introduction

Buchanan Building D consists of 1-level below grade (basement with M&E rooms) and 3-levels above ground with classrooms/student services. The building is presently being renovated and our current mandate is to provide an estimate of the cost to replace the salvaged components of the existing building. The gross floor area of the project, measured in accordance with the Canadian Institute of Quantity Surveyors guidelines is 5,090 square meters.

6.2. Current Cost Estimate

The current estimated construction cost for the building based on the information provided is summarized as follows:

Element	Estimate	Cost per Square Meter	% of Total
Structure	$ 3,146,290	$ 618.13	41.0
Envelope	$ 1,427,919	$ 280.53	18.7
Interiors	$ 1,109,246	$ 217.93	14.5
Services	$ 1,099,135	$ 215.94	14.4
Site and Ancilliary	$ 26,900	$ 5.28	0.4
General Requirements and Fee	$ 840,972	$ 165.22	11.0
Contingencies / Design Fees	—	—	0.0
Total	**$ 7,650,462**	**$ 1,503.03**	**100.0**

Please note that the value of excavation and backfill work only is $421,500, excluding GST and is not included in the above figures. There is no landscaping, paving or other site work included in the above figures. These numbers are consolidated in the table below.

Salvaged Value Estimate Table

Summary	Estimated Costs	Cost per Square Meter	Cost per Square Foot
Salvaged Value of the Building	$ 7,650,500	$ 1,503.05	$ 139.69
Excavation	$ 421,500	$ 82.81	$ 7.70
Total Demolition	$ 400,000	$ 78.59	$ 7.30
Subtotal	**$ 8,472,000**	**$ 1,644.45**	**$ 154.69**
Block D Renovation - Tendered	$ 5,920,000	$ 1,163.06	$ 108.09
Total Estimated Cost	**$ 14,392,000**	**$ 2,827.51**	**$ 262.78**

6.3. Basis of Estimate

The estimated costs are based on the outline specifications and assumptions in Appendix D (section 6), the design information provided as outlined in Appendix D (section 5) of this report.

6.4. Contingencies

- Design Contingency: This contingency covers unforeseen items during the design phase from conceptual design through to tender documents. The contingency is established at the preliminary design stage and is ultimately reduced to zero at tender documents stage estimates. We have not included a Design Contingency as the estimate is prepared from as built drawings.
- Escalation Contingency: This contingency provides for increases to the cost of labour, materials and equipment due to changes in market conditions between the date of the estimate and the date of tender closing. We have not included an escalation contingency as the mandate was an estimate in 2006 dollars.
- Construction Contingency: This is an allowance to cover unforeseen items during the construction period resulting in change orders to the contract(s) awarded. We have not included a construction contingency as the estimate is prepared from as built drawings.

6.5. Exclusions / Qualifications

Please note the following exclusions to this estimate in addition to those listed at Appendix 7.

- Loose furniture, fittings and equipment (FF&E)
- Excavation & backfill
- Site development
- Mechanical Site Services

7. Conclusions

In conclusion, it is both environmentally and economically more advantageous to renovate Buchanan Building D rather than completely demolish it and construct a new facility based on the analysis completed in this study.

Environmentally, considerable embodied energy, pollution and natural resource impacts are avoided by retaining building components. In parallel, by retaining building components, the quantity of materials that was not sent to landfill (or to recycling facilities) is significantly greater than what is sent as a consequence of the selective demolition process. As a stand alone exercise of assessing the avoided environmental impacts of retaining major structural and envelope components of Building D, the University of British Columbia has prevented:

- 218,919 kg of solid waste from being sent to local landfills or recycling facilities;
- 773,248 Kg of CO_2 equivalent emissions from being released into the atmosphere; and
- 12.3 million Mega Joules of primary energy from being consumed during the manufacturing, construction and end-of-life stages, the equivalent of 300,000 litres of heavy fuel.

In the comparative exercise between the Renovated and New Building models, the overall environmental impact ratios for the New Building compared to the Renovated Building over its life span are as follows:

- 6% (21,169,363 MJ) less primary energy is consumed;
- 19% (147,607kg) more solid waste is created;
- 8% (692,173 air pollution index) less air pollution is emitted;
- 41% (314 water pollution index) more water pollution is emitted;
- 5% (969,726 kg CO_2 Equivalent) less CO_2 equivalent is emitted; and finally
- 65% (4,460,831kg) more natural resource is used.

As a result of analyzing the Renovation and New Building schemes, the inclusion of Total Operating Energy consumption became a determining factor since its effect is greatly accentuated by the life-expectancy of the building. For instance, even though the renovation project has substantially lower environmental impacts in three (Solid Waste, Water Pollution Index, Natural Resources) of the six analysed categories, the New Building scheme has slightly smaller environmental footprint in the other three (Primary Energy Consumption, Air Pollution Index, and Global Warming Potential).

The real environmental advantage of renovating a building lies within the possibilities of making it more energy-efficient to operate, which is on a case-by-case basis, and the conservation of primary natural resources. Since the only area where it is more advantageous to construct a new building is the Total Operating Energy saved, some additional measures can be taken to narrow the gap between the energy efficiency of the existing and the new buildings. In the case of Buchanan Building D renovation, measures such as adding insulation on the roof or on the concrete masonry block up-stand walls located below the windows might lead to a better performing building envelope. It should be noted that the glazing system comprises the vast majority of the wall area and it is currently being upgraded with double-glazed units as part of the renovation.

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Financially, the salvage value of the retained components was estimated to be $7,650,500, which equates to approximately $1,500 per square meter. In addition, it was estimated to cost $400,000 for full demolition of the existing building and $421,500 for excavation work associated with the New Building scheme. When adding these three costs together with the tendered costs of $5,920,000 for Building D, the scheme of a completely new building would have potentially cost $14,392,500. In sum, an estimated $8,472,000 has been saved by choosing to renovate rather than construct a new building.

This study, finally, provides an in-depth look at the salvaged value, environmental life cycle benefits and ramifications, and the tradeoffs of renovating versus constructing a new building. In the case of Buchanan Building D along with the objectives of UBC's Renew program, the project will result in a more cost effective solution and a building that will have a comparatively low environmental life cycle impact, particularly with respect to water pollution, resource use, and solid waste.

Appendix A: EIE Definitions for Environmental Implications

The Environmental Impact Estimator generates the following environmental implications:

- Embodied primary energy use (MJ)
- Global warming potential (GWP) (CO_2 equivalent)
- Solid Waste (kg)
- Index of Water Effects
- Index of Air Pollution Effects
- Natural Resource use (kg)

These implications are defined by the Athena Sustainable Materials Institute as follows:

Embodied primary energy use (MJ): Embodied primary energy includes all energy, direct and indirect, used to transform or transport raw materials into products and buildings, including inherent energy contained in raw or feedstock materials that are also used as common energy sources. For example, natural gas used as a raw material in the production of various plastic (polymer) resins. In addition, the model captures the indirect energy use associated with processing, transporting, converting and delivering fuel and energy.

Global warming potential (GWP) (CO_2 equivalent): GWP is a reference measure and carbon dioxide is the common reference standard for global warming or greenhouse gas effects. All other greenhouse gases are referred to as having a "CO_2 equivalence effect" which is simply a multiple of the greenhouse potential (heat trapping capability) of carbon dioxide. This effect has a time horizon due to the atmospheric reactivity or stability of the various contributing gases over time.

As yet, no consensus has been reached among policy makers about the most appropriate time horizon for greenhouse gas calculations. The International Panel on Climate Change 100-year time horizon figures have been used here as a basis for the equivalence index:

CO_2 Equivalent kg = CO_2 kg + (CH_4 kg x 23) + (N_2O kg x 296)

While greenhouse gas emissions are largely a function of energy combustion, some products also emit greenhouse gases during the processing of raw materials. Process emissions often go unaccounted for due to the complexity associated with modeling manufacturing process stages. One example where process CO_2 emissions are significant is in the production of cement (calcination of limestone). Because Athena™ uses data developed by a detailed life cycle modeling approach, all relevant process emissions of greenhouse gases are included in the resultant global warming potential index.

Solid Waste (kg): Solid waste is reported on a mass basis in kilograms and is generally self-explanatory. No attempt has been made to further characterize emissions to land as either hazardous or non-hazardous.

Index of Water and Air Pollution Effects: Water and air pollution effects indices are similarly intended to capture the pollution or human health effects of groups of substances emitted at various life cycle stages. In this case we used the commonly recognized and accepted critical volume method

to estimate the volume of ambient air or water that would be required to dilute contaminants to acceptable levels, where acceptability is defined by the most stringent standards (i.e., drinking water standards).

Athena™ calculates and reports these critical volume measures based on the worst offender -- that is, the substance requiring the largest volume of air and water to achieve dilution to acceptable levels. The hypothesis is that the same volume of air or water can contain a number of pollutants. However, there are concerns about the cumulative or synergistic effects of some substances and we therefore expect to further refine our approach in the future.

Natural Resource use (kg): Raw resource use can be measured in common units such as tonnes, but a unit of one resource like iron ore is not at all comparable to a unit of another resource life timber or coal when it comes to environmental implications of extracting resources. Since the varied effects of resource extraction, (e.g., effects on bio-diversity, ground water quality and wildlife habitat, etc.) are a primary concern, the tool makes sure they are taken into account. The problem is that while these ecological carrying capacity effects are as important as the basic life cycle inventory data, they are much harder to incorporate for a number of reasons, especially their highly site-specific nature.

Our approach was to survey a number of resource extraction and environmental specialists across Canada to develop subjective scores of the relative effects of different resource extraction activities. The scores reflect the expert panel ranking of the effects of extraction activities relative to each other for each of several impact dimensions. The scores were combined into a set of resource-specific index numbers, which are applied in Athena™ as weights to the amounts of raw resources used to manufacture each building product. The Weighted Resource Use values reported by Athena™ are the sum of the weighted resource requirements for all products used in each of the designs. They can be thought of as “ecologically weighted kilograms”, where the weights reflect expert opinion about the relative ecological carrying capacity effects of extracting resources. Excluded from this measure are energy feedstocks used as raw materials. Except for coal, no scoring survey has been conducted on the effects of extracting fossil fuels, and hence, they have been assigned a score of one to only account for their mass. The weighting factor for each raw material is set out below:

- Weighted Resource Use
- Same as normal resource converted to mass quantities except:
- LIMESTONE * 1.5
- IRON ORE * 2.25
- COAL * 2.25
- WOODFIBER * 2.5

All other measures are indices requiring more explanation and interpretation. They have been developed because of the difficulty of using and interpreting detailed life cycle inventory results. For example, it takes considerable expertise to understand and appreciate the significance of the individual emissions to air and water. Both categories encompass a relatively large number of individual substances with varying environmental impacts. In the case of raw resource use, there is no real basis for comparison from one material to another in terms of environmental impact. The model therefore compiles related numeric results into indices that summarise the results by indicating potentials for environmental impacts.

Appendix B: Model Results

The following tables summarize modeled results referred to in section 5.2:

Table 5.2a - Model 2 End-of-Life Results

	Manufacturing	Construction	Operations and Maintenance	End-of-life	Total Embodied	Operating Energy
Primary Energy Consumption (MJ)	n/a	n/a	n/a	28,224	28,224	n/a
Soild Waste (kg)	n/a	n/a	n/a	0	0	n/a
Air Pollution Index	n/a	n/a	n/a	10	10	n/a
Water Pollution Index	n/a	n/a	n/a	0	0	n/a
Global Warming Potential (kg) (CO_2 equivalent)	n/a	n/a	n/a	53	53	n/a
Weighted Resource Use (kg)	n/a	n/a	n/a	641	641	n/a

Table 5.2b - Model 2 Bills of Materials Recycled or Sent to Landfill (Main Items)

Materials	Quantity
Concrete Blocks	226
Mortar	18 m^3
Rebar, Rod, Light Sections	0.09 tonnes
Stucco over porous surface	1,800 m^2
Aluminum	0.30 tonnes
Clay tile	5,305 m^2
Aluminum frame	1,771 m
Standard glazing	701 m^2

Table 5.2c - Model 3 Retained Components Summary Measures

	Manufacturing	Construction	Operations and Maintenance	End-of-life	Total Embodied	Operating Energy
Primary Energy Consumption (MJ)	n/a	n/a	574,667	181,007	755,674	340,542,878
Soild Waste (kg)	n/a	n/a	4,998	2	5,000	713,294
Air Pollution Index	n/a	n/a	18,307	85	18,392	8,394,701
Water Pollution Index	n/a	n/a	2	0	2	664
Global Warming Potential (kg) (CO_2 equivalent)	n/a	n/a	52,600	410	53,010	17,515,826
Weighted Resource Use (kg)	n/a	n/a	71,294	4,107	75,401	6,307,239

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Table 5.2d - Model 4 Renovation Work Summary Measures

	Manufacturing	Construction	Operations and Maintenance	End-of-life	Total Embodied	Operating Energy
Primary Energy Consumption (MJ)	1,598,540	57,128	638,950	7,977	2,302,595	n/a
Soild Waste (kg)	46,555	5,092	11,820	0	63,467	n/a
Air Pollution Index	30,698	203	48,176	7	79,084	n/a
Water Pollution Index	87	0	4	0	91	n/a
Global Warming Potential (kg) (CO_2 equivalent)	114,734	1,182	125,102	27	241,045	n/a
Weighted Resource Use (kg)	284,638	1,309	145,808	181	431,936	n/a

Table 5.2e - Renovated Building Scheme Overall Summary Measures (sum of tables 5.2a, 5.2c, 5.2d)

	Manufacturing	Construction	Operations and Maintenance	End-of-life	Total Embodied	Operating Energy
Primary Energy Consumption (MJ)	1,598,540	57,128	1,213,617	217,208	3,086,493	340,542,878
Soild Waste (kg)	46,555	5,092	16,818	2	68,467	713,294
Air Pollution Index	30,698	203	66,483	102	97,486	8,394,701
Water Pollution Index	87	0	6	0	93	664
Global Warming Potential (kg) (CO_2 equivalent)	114,734	1,182	177,702	490	294,108	17,515,826
Weighted Resource Use (kg)	284,638	1,309	217,102	4,929	507,978	6,307,239

Table 5.2f - Model 1 End-of-Life Results

	Manufacturing	Construction	Operations and Maintenance	End-of-life	Total Embodied	Operating Energy
Primary Energy Consumption (MJ)	n/a	n/a	n/a	209,142	209,142	n/a
Soild Waste (kg)	n/a	n/a	n/a	2	2	n/a
Air Pollution Index	n/a	n/a	n/a	94	94	n/a
Water Pollution Index	n/a	n/a	n/a	0	0	n/a
Global Warming Potential (kg) (CO_2 equivalent)	n/a	n/a	n/a	462	462	n/a
Weighted Resource Use (kg)	n/a	n/a	n/a	4,746	4,746	n/a

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Table 5.2g - Model 1 Bills of Materials Recycled or Sent to Landfill (Main Items)

Materials	Quantity
Concrete 20 Mpa (Flyash average)	1,257 m^3
Concrete 30 Mpa (Flyash average)	1,335 m^3
Concrete Blocks	7,083 blocks
Mortar	76 m^3
Welded Wire Mesh	10.76 tonnes
Rebar, Rod, Light Sections	138.9 tonnes
Galvanized Steel Studs	0.90 tonnes
Extruded Polystyrene (25mm)	1,909 m^2
Standard Brick	1,107 m^2
Stucco Over Metal Mesh	282 m^2
Stucco Over Porous Surface	2,570 m^2
Aluminum	3.90 tonnes
Glazing Panel	10.79 tonnes
Clay Tile	8,081 m^2
Aluminum Frame	1,771 m
Standard Glazing	766 m^2
Mod. Bit. Membrane	1,718 kg

Table 5.2h - Model 5 New Building Summary Measures

	Manufacturing	Construction	Operations and Maintenance	End-of-life	Total Embodied	Operating Energy
Primary Energy Consumption (MJ)	12,789,474	1,527,013	1,253,645	189,749	15,759,881	289,510,358
Soild Waste (kg)	219,481	49,920	17,994	2	287,397	606,402
Air Pollution Index	166,290	11,020	67,228	92	244,630	7,136,701
Water Pollution Index	467	0	6	0	473	565
Global Warming Potential (kg) (CO_2 equivalent)	872,637	22,125	180,179	438	1,075,379	14,890,968
Weighted Resource Use (kg)	5,335,263	34,670	220,504	4,305	5,594,742	5,362,059

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Table 5.2i - New Building Scheme Overall Summary Measures (sum of tables 5.2f and 5.2h)

	Manufacturing	Construction	Operations and Maintenance	End-of-life	Total Embodied	Operating Energy
Primary Energy Consumption (MJ)	12,789,474	1,527,013	1,253,645	398,891	15,969,023	289,510,358
Soild Waste (kg)	219,481	49,920	17,994	4	287,399	606,402
Air Pollution Index	166,290	11,020	67,228	186	244,724	7,136,701
Water Pollution Index	467	0	6	0	473	565
Global Warming Potential (kg) (CO_2 equivalent)	872,637	22,125	180,179	900	1,075,841	14,890,968
Weighted Resource Use (kg)	5,335,263	34,670	220,504	9,051	5,599,488	5,362,059

Table 5.2j – Comparison Table between Renovated Building versus New Building Scheme

	Manufacturing	Construction	Operations and Maintenance	End-of-life	Total Embodied	Operating Energy	Total Life Cycle
Primary Energy Consumption (MJ)	1,598,540	57,128	1,213,617	217,208	3,086,493	340,542,878	343,629,371
	12,789,474	1,527,013	1,253,645	398,891	15,969,023	306,490,985	322,460,008
Soild Waste (kg)	46,555	5,092	16,818	2	68,467	713,294	781,761
	219,481	49,920	17,994	4	287,399	641,969	929,368
Air Pollution Index	30,698	203	66,843	102	97,486	8,394,701	8,492,187
	166,290	11,020	67,228	186	244,724	7,555,290	7,800,014
Water Pollution Index	87	0	6	0	93	664	757
	467	0	6	0	473	598	1,071
Global Warming Potential (kg) (CO_2 equivalent)	114,734	1,182	177,702	490	294,108	17,515,826	17,809,934
	872,637	22,125	180,179	900	1,075,841	15,764,367	16,840,208
Weighted Resource Use (kg)	284,638	1,309	217,102	4,929	507,978	6,307,239	6,815,217
	5,335,263	34,670	220,504	9,051	5,599,488	5,676,560	11,276,048

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Table 5.2g - Model 1 Bills of Materials Recycled or Sent to Landfill (Main Items)

Materials	Quantity
Concrete 20 Mpa (Flyash average)	0 m^3 1,257 m^3
Concrete 30 Mpa (Flyash average)	0 m^3 1,335 m^3
Concrete Blocks	226 blocks 7,083 blocks
Mortar	18 m^3 76 m^3
Welded Wire Mesh	0 tonnes 10.76 tonnes
Rebar, Rod, Light Sections	0.09 tonnes 138.9 tonnes
Galvanized Steel Studs	0 tonnes 0.90 tonnes
Extruded Polystyrene (25mm)	0 m^2 1,909 m^2
Standard Brick	0 m^2 1,107 m^2
Stucco Over Metal Mesh	0 m^2 282 m^2
Stucco Over Porous Surface	1,800 m^2 2,570 m^2
Aluminum	0.30 tonnes 3.90 tonnes
Glazing Panel	0 tonnes 10.79 tonnes
Clay Tile	5,305 m^2 8,081 m^2
Aluminum Frame	1,771 m 1,771 m
Standard Glazing	701 m^2 766 m^2
Mod. Bit. Membrane	0 kg 1,718 kg

APPENDIX 1

Elemental Cost Estimate Summary and Detail

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Salvaged Value Estimate

Project: UBC Buchanan D Salvaged Value Estimate
Location: Vancouver, BC
Client: UBC
Architect: Busby, Perkins + Will

Date: 10-Jul-06
Project Number: 26792
GLA: 5090 m2

Element	Cost Ratio	Ratio to Area	Elemental Quantity	Elemental Unit Rate	Elemental Amount	5090 Cost/m2	Amount	% of Total
A SHELL								
A1 SUBSTRUCTURE	**3.57%**					**$47.59**		
A11 Foundation	3.57%	0.35	1,774 m2	$136.55	$242,231	$47.59		
A12 Basement Excavation	0.00%	0.00	0 m3	$0.00	$0	$0.00	**$242,200**	3%
A2 STRUCTURE	**36.09%**					**$480.94**		
A21 Lowest Floor Construction	2.14%	0.35	1,774 m2	$81.90	$145,292	$28.54		
A22 Upper Floor Construction	25.76%	0.79	4,040 m2	$432.52	$1,747,400	$343.30		
A23 Roof Construction	8.19%	0.34	1,716 m2	$323.59	$555,277	$109.09	**$2,448,000**	32%
A3 EXTERIOR ENCLOSURE	**27.78%**					**$370.14**		
A31 Walls Below Grade	6.72%	0.19	984 m2	$463.51	$456,090	$89.61		
A32 Walls Above Grade	16.48%	0.34	1,737 m2	$643.52	$1,117,786	$219.60		
A33 Windows & Entrances	0.44%	0.01	45 m2	$665.31	$29,939	$5.88		
A34 Roof Covering	2.72%	0.34	1,708 m2	$108.20	$184,810	$36.31		
A35 Projections	1.41%	0.12	634 m2	$150.35	$95,384	$18.74	**$1,884,000**	25%
B INTERIORS								
B1 PARTITIONS & DOORS	**8.72%**					**$116.20**		
B11 Partitions	8.14%	0.29	1,493 m2	$369.62	$551,799	$108.41		
B12 Doors	0.58%	0.01	35 lvs	$1,132.77	$39,647	$7.79	**$591,400**	8%
B2 FINISHES	**5.01%**					**$66.77**		
B21 Floor Finishes	2.04%	0.26	1,303 m2	$106.15	$138,318	$27.17		
B22 Ceiling Finishes	2.00%	0.26	1,303 m2	$104.30	$135,905	$26.70		
B23 Wall Finishes	0.97%	0.86	4,370 m2	$15.02	$65,624	$12.89	**$339,800**	4%
B3 FITTING & EQUIPMENT	**2.62%**					**$34.96**		
B31 Fitting & Fixtures	2.57%	1.00	5,090 m2	$34.27	$174,453	$34.27		
B32 Equipment	0.05%	1.00	5,090 m2	$0.69	$3,500	$0.69		
B33 Conveying Systems	0.00%	0.00	0 no.	$0.00	$0	$0.00	**$178,000**	2%
C SERVICES								
C1 MECHANICAL	**13.81%**					**$184.07**		
C11 Plumbing & Drainage	3.69%	1.00	5,090 m2	$49.17	$250,300	$49.17		
C12 Fire Protection	0.39%	1.00	5,090 m2	$5.22	$26,550	$5.22		
C13 H.V.A.C.	8.64%	1.00	5,090 m2	$115.06	$585,680	$115.06		
C14 Controls	1.10%	1.00	5,090 m2	$14.62	$74,400	$14.62	**$936,900**	12%
C2 ELECTRICAL	**2.39%**					**$31.87**		
C21 Service & Distribution	0.55%	1.00	5,090 m2	$7.37	$37,500	$7.37		
C22 Lighting, Devices & Heating	1.32%	1.00	5,090 m2	$17.60	$89,575	$17.60		
C23 Systems & Ancillaries	0.52%	1.00	5,090 m2	$6.90	$35,130	$6.90	**$162,200**	2%
NET BUILDING COST (Excluding Site)	**100.00%**				$6,782,590	$1,332.51	**$6,782,500**	89%
D SITE & ANCILLARY WORK								
D1 SITE WORK						**$5.28**		
D11 Site Development		1.00	5,090 m2	$0.00	$0	$0.00		
D12 Mechanical Site Services		1.00	5,090 m2	$0.00	$0	$0.00		
D13 Electrical Site Services		1.00	5,090 m2	$5.28	$26,900	$5.28	**$26,900**	0.4%
D2 ANCILLARY WORK						**$0.00**		
D21 Demolition		1.00	5,090 m2	$0.00	$0	$0.00		
D22 Alterations		1.00	5,090 m2	$0.00	$0	$0.00	**$0**	0%
NET BUILDING COST (Including Site)					$6,809,490	$1,337.82	**$6,809,500**	89%
Z GENERAL REQUIREMENTS & ALLOWANCES								
Z1 GEN. REQ. & FEE	**12.0%**					**$165.22**		
Z11 General Requirements	7.0%				$476,664	$93.65		
Z12 Fee	5.0%				$364,308	$71.57	**$841,000**	11%
TOTAL CONSTRUCTION ESTIMATE (Excluding Allowances)					$7,650,462	$1,503.05	**$7,650,500**	100%
Z2 ALLOWANCES	**0.0%**					**$0.00**		
Z21 Design Allowance	0.0%				$0	$0.00		
Z22 Escalation Allowance	0.0%				$0	$0.00		
Z23 Construction Allowance	0.0%				$0	$0.00	**$0**	0%
TOTAL CONSTRUCTION ESTIMATE (Including Allowances)					$7,650,500	**$1,503.05**	**$7,650,500**	100%
GOOD & SERVICES TAX	0.00%		EXCLUDED		$0	$0.00	**$0**	0%
TOTAL CONSTRUCTION ESTIMATE (Including Allowances)					$7,650,500	**$1,503.05**	**$7,650,500**	100%
					Cost/sqft	**$139.64**		

Minor Section Code	Item Description	Takeoff Qty	Unit	Total Unit Price	Grand Total
	A11 Foundations				
	(Unassigned)				**1000**
7100	Waterproofing to Mech. Pits	1.00	each	1000.00	1000
	Pad Footings - Square/Rect to 3' Dp (Type A) 45kg/m3	**4.00**	**each**	**918.46**	**3674**
	Pad Footings - Square/Rect to 3' Dp (Type B) 45kg/m3	**8.00**	**each**	**1051.13**	**8409**
	Pad Footings - Square/Rect to 3' Dp (Type C) 45kg/m3	**6.00**	**each**	**296.35**	**1778**
	Pad Footings - Square/Rect to 3' Dp (Type D) 45kg/m3	**1.00**	**each**	**4537.48**	**4537**
	Pad Footings - Square/Rect to 3' Dp (Type E) 45kg/m3	**2.00**	**each**	**5254.04**	**10508**
	Pad Footings - Square/Rect to 3' Dp (Type F) 45kg/m3	**2.00**	**each**	**6815.54**	**13631**
	Pad Footings - Square/Rect to 3' Dp (Type G) 45kg/m3	**1.00**	**each**	**7164.99**	**7165**
	Pad Footings - Square/Rect to 3' Dp (Type H) 45kg/m3	**6.00**	**each**	**5994.47**	**35967**
	Tie Beams - Standard to 3' Dp; 120kg/m3	**105.54**	**lnm**	**188.52**	**19896**
	Strip Footings - Standard to 3' Dp; 45kg/m3	**282.23**	**lnm**	**274.03**	**77338**
	Strip Footings - Standard Over 3' Dp; 45kg/m3	**6.10**	**lnm**	**936.20**	**5711**
	Columns - Square/Rect; 160kg/m3	**14.77**	**m3**	**2526.23**	**37305**
	Perimeter Drain	**220.00**	**lnm**	**68.65**	**15103**
	Mass Concrete Pier	**0.07**	**m3**	**3167.91**	**208**
	A11 Foundations Total	**1774.00**	**m2**	**136.55**	**242231**
	A12 Basement Excavation				
	(Unassigned)				**0**
1020	Separate estimate		lsum	1.00	0
	A12 Basement Excavation Total				**0**
	A21 Lowest Floor Construction				
	Slab on Grade - Reinforced, Steel Trowel Finish; 45kg/m3	**699.07**	**m2**	**52.09**	**36415**
	Slab on Grade - Reinforced, Steel Trowel Finish (West Arcade) 45kg/m3	**282.42**	**m2**	**44.07**	**12446**
	Slab on Grade - Reinforced, Steel Trowel Finish (East Arcade) 45kg/m3	**792.46**	**m2**	**51.61**	**40902**
	Ground Beams - Standard to 3' Dp; 120kg/m3	**198.12**	**lnm**	**280.28**	**55528**
	A21 Lowest Floor Construction Total	**1774.00**	**m2**	**81.90**	**145292**
	A22 Upper Floor Construction				
	(Unassigned)				**25450**
3500	Allowance for Concrete Sundries (Expansion Joints, Caulking etc,)	5090.00	m2	5.00	25450
	Columns - Square/Rect (Basement) 160kg/m3	**13.79**	**m3**	**2331.07**	**32153**
	Columns - Square/Rect (Ground Floor) 160kg/m3	**40.77**	**m3**	**2868.16**	**116923**
	Suspended Slab - Non Typical Including Beams (Ground Floor) Av121kg/m3	**621.88**	**m2**	**277.52**	**172581**
	Columns - Square/Rect (Level 2) 160kg/m3	**25.10**	**m3**	**3230.15**	**81088**
	Suspended Slab - Non Typical Including Beams (Level 2) Av123kg/m3	**1702.00**	**m2**	**329.62**	**561014**
	Columns - Square/Rect (Level 3) 160kg/m3	**25.77**	**m3**	**3189.91**	**82197**
	Suspended Slab - Non Typical Including Beams (Level 3) Av122kg/m3	**1716.00**	**m2**	**324.75**	**557277**
	Stairs - Cast in Place Elevated	**4.14**	**vlm**	**2187.27**	**9055**
	Stairs - Cast in Place Elevated	**3.35**	**vlm**	**2401.18**	**8045**
	Stairs - Cast in Place Elevated	**3.81**	**vlm**	**5169.34**	**19697**
	Stairs - Cast in Place Elevated	**3.35**	**vlm**	**5731.56**	**19201**
	Stairs - Cast in Place Elevated (Link Stairs)	**8.35**	**vlm**	**6830.36**	**57041**
	Stairs - Cast in Place Elevated (Link Stair)	**0.88**	**vlm**	**6489.43**	**5678**
	A22 Upper Floor Construction Total	**4040.00**	**m2**	**432.52**	**1747400**
	A23 Roof Construction				
	Roof Slab - Non Typical Including Beams; Av 122kg/m3	**1716.00**	**m2**	**323.59**	**555277**
	A23 Roof Construction Total	**1716.00**	**m2**	**323.59**	**555277**
	A31 Walls Below Grade				
	Wall - Exterior Below Grade With Mirra Drain (Mech Room Pits) 100kg/m3	**48.37**	**m2**	**482.20**	**23324**
	Wall - Exterior Below Grade With Mirra Drain (10" thk) 100kg/m3	**590.76**	**m2**	**471.76**	**278699**
	Wall - Exterior Below Grade With Mirra Drain (8" thk) 100kg/m3	**332.28**	**m2**	**447.56**	**148715**
	Wall - Exterior Below Grade With Mirra Drain (6" thk) 100kg/m3	**12.59**	**m2**	**425.15**	**5353**
	A31 Walls Below Grade Total	**984.00**	**m2**	**463.51**	**456090**
	A32 Walls Above Grade				
	(Unassigned)				**537271**
3470	E/O Chamfer strip in concrete	302.00	lnm	5.00	1510
4210	Brick Veneer to exterior concrete walls (incl. blue skin, ties and related work)	462.00	m2	290.00	133980
6111	Misc. Blocking @ radiant heating cabinets	302.00	lnm	15.07	4552
7460	Metal Panels (Originally Porcelain Enamel Panels) on clips	356.00	m2	452.00	160912
7460	Metal Panel System @ D/E link (with louvres)	9.00	m2	430.40	3874
7920	Sealants and Caulking Allowance @ metal panels	356.00	m2	14.05	5002
8920	Curtain Wall - Kawneer 1600 Series (Meekinson Lounge)	263.00	m2	807.00	212241
9945	Clear Silicone (low-pressure Spray) over Masonry	462.00	m2	18.90	8732
9945	Elastomerics & Mastics - Exterior Concrete walls	220.00	m2	26.90	5918
9945	Elastomerics & Mastics - Exterior Concrete walls at D/E link	20.50	m2	26.90	551
	CMU Backup to the Metal Panels	**229.48**	**m2**	**221.73**	**50883**
	Sill wall @ main floor	**156.00**	**m2**	**51.80**	**8081**
	Walls - Concrete Above Grade; 90kg/m3	**1234.86**	**m2**	**422.36**	**521550**
	A32 Walls Above Grade Total	**1737.00**	**m2**	**643.52**	**1117786**
	A33 Windows and Entrances				
	(Unassigned)				**28386**
8520	Aluminum Windows - Plate glass @ D/E link	31.50	m2	645.60	20336

Minor Section Code	Item Description	Takeoff Qty	Unit	Total Unit Price	Grand Total
8920	e/o for Double Doors/Hardware	3.00	pair	1600.00	4800
8920	E/O Automatic Single Doors/Hardware	1.00	each	3250.00	3250
	Hollow Metal Single Exit Door	**1.00**	**each**	**1552.41**	**1552**
	A33 Windows and Entrances Total	**45.00**	**m2**	**665.31**	**29939**
	A34 Roof Covering				
	(Unassigned)				**11691**
6111	Misc. Blocking @ roof edge	215.00	lnm	15.07	3241
7600	Roof Flashing	215.00	lnm	30.00	6450
7700	Roof Hatches	2.00	each	1000.00	2000
	Built-up roofing	**1708.00**	**m2**	**89.24**	**152414**
	25 mm concrete topping to roof construction	**1708.00**	**m2**	**12.12**	**20705**
	A34 Roof Covering Total	**1708.00**	**m2**	**108.20**	**184810**
	A35 Projections				
	(Unassigned)				**85036**
5520	Standard metal guardrail with glazing	12.30	lnm	300.00	3690
9220	Stucco to soffit (u/s of level 2)	630.00	m2	129.12	81346
	Glazed Canopy to Meekinson Lounge	**4.37**	**m2**	**2368.06**	**10348**
	A35 Projections Total	**634.37**	**m2**	**150.36**	**95384**
	B11 Partitions				
	(Unassigned)				**269394**
4210	Brick Veneer to interior concrete walls (incl. ties and related work)	663.00	m2	333.50	221111
8410	Aluminum Interior Glazing at Main Entrance (Meekinson Lounge)	41.00	m2	452.00	18532
8852	Interior Glazed Partition, Single Clear Tempered Glass (Meekinson Lounge)	60.00	m2	376.60	22596
8852	Clearstory Glazing, Single Clear Glass (Meekinson Lounge)	19.00	m2	376.60	7155
	6" Concrete Block Partition (Basement M&E)	**318.25**	**m2**	**175.22**	**55764**
	8" CMU Partition (replacing 4" CMU/4" HC Tile)	**307.06**	**m2**	**214.16**	**65759**
	4" CMU (4" Hollow Clay Tile)	**563.86**	**m2**	**152.83**	**86171**
	Furred Walls - to CMU walls	**1463.95**	**m2**	**37.13**	**54351**
	Interior Metal Stud Wall (Meekinson Lounge)	**183.75**	**m2**	**110.80**	**20360**
	B11 Partitions Total	**1492.92**	**m2**	**369.61**	**551799**
	B12 Doors				
	(Unassigned)				**11200**
8852	E/O Single Door Hardware to Interior Glazed Screen	8.00	each	1000.00	8000
8852	E/O Double Door Hardware to Interior Glazed Screen	2.00	each	1600.00	3200
	Wood doors	**15.00**	**each**	**1300.74**	**19511**
	Hollow Metal Doors and Frames - Single	**8.00**	**each**	**1117.03**	**8936**
	B12 Doors Total	**35.00**	**lvs**	**1132.78**	**39647**
	B21 Floor Finishes				
	(Unassigned)				**62782**
9310	Ceramic Floor Tile to Washrooms	198.00	m2	91.50	18117
9400	Terrazzo in main floor corridor	70.00	m2	225.00	15750
9665	Linoleum Sheet Flooring	535.00	m2	51.13	27355
9680	In-lay Carpet @ meeting rooms	29.00	m2	53.80	1560
	25 mm concrete topping to floor construction	**3418.00**	**m2**	**12.12**	**41435**
	100 mm concrete topping to floor construction	**1095.00**	**m2**	**31.14**	**34102**
	B21 Floor Finishes Total	**1303.00**	**m2**	**106.15**	**138318**
	B22 Ceiling Finishes				
	(Unassigned)				**41090**
8305	Access Panel (Inspection hatch in GWB ceiling)	5.00	each	500.00	2500
9120	2' x 2' Acoustic T-bar ceiling	542.00	m2	71.20	38590
	Drywall Ceiling	**761.00**	**m2**	**46.61**	**35470**
	Drywall Bulkheads at Walls	**530.00**	**lnm**	**111.97**	**59345**
	B22 Ceiling Finishes Total	**1303.00**	**m2**	**104.30**	**135905**
	B23 Wall Finishes				
	(Unassigned)				**65624**
9310	Ceramic Wall Tile to Washrooms	282.00	m2	91.50	25803
9310	Ceramic Tile Base	116.00	lnm	32.80	3805
9678	Resilient Base	617.00	lnm	8.20	5059
9900	Rolled Latex Based Paint 3 Coats - Walls	3425.00	m2	5.38	18427
9945	Clear Silicone (low-pressure Spray) over Interior Masonry	663.00	m2	18.90	12531
	B23 Wall Finishes Total	**4370.00**	**m2**	**15.02**	**65624**
	B31 Fittings and Fixtures				
	(Unassigned)				**174453**
5500	Trench Drain Grate & Frame	2.00	lnm	200.00	400
5500	In-lay foot grille (6' x 8')	2500.00	lsum	1.00	2500
5515	Galvanized Roof Access Ladders	10.00	lnm	508.53	5085
5515	Pit Ladders (5)	15.00	each	311.68	4675
5530	Steel Grating	15.00	m2	430.00	6450
5700	Steel Pipe Railings (M&E)	12.00	lnm	492.13	5906
6200	Millwork Allowance (food service counter)	42.00	lnm	1200.00	50400

Minor Section Code	Item Description	Takeoff Qty	Unit	Total Unit Price	Grand Total
6200	Millwork Allowance (Base + upper cabinets)	10.00	lnm	984.00	9840
6200	Millwork Allowance (Shelving)	11.00	lnm	300.00	3300
6200	Millwork Allowance (counter)	6.00	lnm	350.00	2100
8824	Mirror Wall (3) 5.5m x 1.0m	16.50	m2	65.00	1073
8824	Mirrors 24" x 36"	4.00	each	250.00	1000
10160	Metal Toilet Partition	30.00	each	900.00	27000
10160	Metal Urinal Screen	1.00	each	320.00	320
10185	Shower Cubicles	1.00	each	400.00	400
10440	Interior Signs Allowance	1.00	lsum	5000.00	5000
10800	Grab Bar - Stainless Straight	1.00	each	96.74	97
10800	Grab Bar - Stainless Angular	1.00	each	86.48	86
10800	Soap Dish in shower	1.00	each	65.00	65
10800	Feminine Napkin Dispenser - flush mounted	23.00	each	40.00	920
10800	Robe Hooks	32.00	each	35.00	1120
10800	Toilet Paper Holder	31.00	each	150.00	4650
10800	Hand Dryer	8.00	each	850.00	6800
10800	Soap dispenser	8.00	each	50.00	400
10800	Seat (next to shower)	1.00	each	380.00	380
12510	Horizontal PVC Blinds (Classrooms)	594.00	m2	53.82	31969
12520	Roller Shades (Meekinson)	39.00	m2	64.56	2518
12600	Meekinson Lounge Benches NIC		each		0
	B31 Fittings and Fixtures Total	**5090.00**	**m2**	**34.27**	**174453**
	B32 Equipment				
	(Unassigned)				**3500**
11722	Whiteboard 8' x 4'	2.00	each	750.00	1500
11722	Tack surface on a pivoting panel	2.00	each	1000.00	2000
	B32 Equipment Total	**5090.00**	**m2**	**0.69**	**3500**
	B33 Conveying Systems				
	(Unassigned)				**0**
1020	Allowances		lsum	1.00	0
	B33 Conveying Systems Total	**5090.00**	**m2**		**0**
	C11 Plumbing and Drainage				
	(Unassigned)				**250300**
15400	Plumbing and Drainage	250300.00	lsum	1.00	250300
	C11 Plumbing and Drainage Total	**5090.00**	**m2**	**49.17**	**250300**
	C12 Fire Protection				
	(Unassigned)				**26550**
15300	Fire Protection	26550.00	lsum	1.00	26550
	C12 Fire Protection Total	**5090.00**	**m2**	**5.22**	**26550**
	C13 HVAC				
	(Unassigned)				**585680**
15500	Heating Ventilating and Air Conditioning	585680.00	lsum	1.00	585680
	C13 HVAC Total	**5090.00**	**m2**	**115.06**	**585680**
	C14 Controls				
	(Unassigned)				**74400**
15950	HVAC Controls	74400.00	lsum	1.00	74400
	C14 Controls Total	**5090.00**	**m2**	**14.62**	**74400**
	C21 Services and Distribution				
	(Unassigned)				**37500**
16400	Service and Distribution	37500.00	lsum	1.00	37500
	C21 Services and Distribution Total	**5090.00**	**m2**	**7.37**	**37500**
	C22 Lighting Devices & Heating				
	(Unassigned)				**89575**
16500	Lighting & Power	89575.00	lsum	1.00	89575
	C22 Lighting Devices & Heating Total	**5090.00**	**m2**	**17.60**	**89575**
	C23 Systems Ancilliaries				
	(Unassigned)				**35130**
16600	Special Systems	35130.00	lsum	1.00	35130
	C23 Systems Ancilliaries Total	**5090.00**	**m2**	**6.90**	**35130**
	D11 Site Development				
	(Unassigned)				**0**
2900	Site Development Excluded			1.00	0
	D11 Site Development Total	**5090.00**	**m2**		**0**
	D12 Mechanical Site Services				
	(Unassigned)				**0**

Minor Section Code	Item Description	Takeoff Qty	Unit	Total Unit Price	Grand Total
2710	Mechanical Site Services Excluded		lsum	1.00	0
	D12 Mechanical Site Services Total	**5090.00**	**m2**		**0**
	D13 Electrical Site Services				
	(Unassigned)				**26900**
2790	Electrical Site Services (connection)	26900.00	lsum	1.00	26900
	D13 Electrical Site Services Total	**5090.00**	**m2**	**5.28**	**26900**
	D21 Demolition				
	(Unassigned)				**0**
1020	Allowances		lsum	1.00	0
	D21 Demolition Total	**5090.00**	**m2**		**0**
	D22 Alterations				
	(Unassigned)				**0**
1020	Allowances		lsum	1.00	0
	D22 Alterations Total	**5090.00**	**m2**		**0**
	Z11 General Requirements				
	(Unassigned)				**0**
1020	General Requirements & Supervision		lsum	1.00	0
	Z11 General Requirements Total	**5090.00**	**m2**		**0**
	Z12 Fee				
	(Unassigned)				**0**
1020	General Contractors Fee		lsum	1.00	0
	Z12 Fee Total	**5090.00**	**m2**		**0**
	Z21 Design Allowance				
	(Unassigned)				**0**
1020	Design Contingency		lsum	1.00	0
	Z21 Design Allowance Total	**5090.00**	**m2**		**0**
	Z22 Escalation Allowance				
	(Unassigned)				**0**
1020	Allowances		lsum	1.00	0
	Z22 Escalation Allowance Total	**5090.00**	**m2**		**0**
	Z23 Construction Allowance				
	(Unassigned)				**0**
1020	Allowances		lsum	1.00	0
	Z23 Construction Allowance Total	**5090.00**	**m2**		**0**
	Grand Total	5090.00	m2	1337.82	6809491

APPENDIX 2

Divisional Cost Estimate Summary and Detail

Salvaged Value Estimate
UBC Buchanan D Salvaged Value Estimate
Vancouver, BC

GFA: 5,090 m2
GLA: 5,090 m2

	Sixteen Division Summary	Estimated Cost	GFA Cost/Sqm	GLA Cost/Sqm	%
1000	Division 01 - General Conditions (see below)	$ -	$ -	$ -	0.0%
2000	Division 02 - Site Work	$ 42,003	$ 8.25	$ 8.25	0.5%
3000	Division 03 - Concrete	$ 3,751,965	$ 737.12	$ 737.12	49.0%
4000	Division 04 - Masonry	$ 537,820	$ 105.66	$ 105.66	7.0%
5000	Division 05 - Metals	$ 64,484	$ 12.67	$ 12.67	0.8%
6000	Division 06 - Wood & Plastics	$ 77,271	$ 15.18	$ 15.18	1.0%
7000	Division 07 - Thermal & Moisture Protection	$ 368,535	$ 72.40	$ 72.40	4.8%
8000	Division 08 - Door & Window	$ 333,123	$ 65.45	$ 65.45	4.4%
9000	Division 09 - Finishes	$ 449,929	$ 88.39	$ 88.39	5.9%
10000	Division 10 - Specialties	$ 47,238	$ 9.28	$ 9.28	0.6%
11000	Division 11 - Equipment	$ 3,500	$ 0.69	$ 0.69	0.0%
12000	Division 12 - Furniture	$ 34,487	$ 6.78	$ 6.78	0.5%
13000	Division 13 - Special Construction	$ -	$ -	$ -	0.0%
14000	Division 14 - Conveying System	$ -	$ -	$ -	0.0%
15000	Division 15 - Mechanical	$ 936,930	$ 184.07	$ 184.07	12.2%
16000	Division 16 - Electrical	$ 162,205	$ 31.87	$ 31.87	2.1%
	Sub Total	$ 6,809,490	$ 1,337.82	$ 1,337.82	89.0%
7.00%	General Requirements	$ 476,664	$ 93.65	$ 93.65	6.2%
5.00%	Contractors Fees	$ 364,308	$ 71.57	$ 71.57	4.8%
	Sub Total	$ 7,650,462	$ 1,503.04	$ 1,503.04	100.0%
0.00%	Design Allowance	$ -	$ -	$ -	0.0%
0.00%	Escalation Allowance	$ -	$ -	$ -	0.0%
0.00%	Construction Allowance	$ -	$ -	$ -	0.0%
	Grand Total	$ 7,650,500	$ 1,503.05	$ 1,503.05	100.0%

CSI	Item Description	Quantity	Unit	Total Unit Price	Total
	Division 01 - General Conditions				
1000	**General Conditions**				
	Division 01 - General Conditions Total				
	Division 02 - Site Work				
2700	**Sewerage and Drainage**				**15,103**
2710	Mechanical Site Services Excluded		lsum	1.00	
2710	Filter Fabric	331	m2	16.50	5,462
2710	Perforated Pipe/Fittings 6"	220	lnm	37.96	8,350
2710	20mm Washed Gravel Material - Tandem Truck [14MT]	20	m3	50.02	990
2710	Place Drain Rock	20	m3	15.16	300
2780	**Power and Communications**				**26,900**
2790	Electrical Site Services (connection)	26900	lsum	1.00	26,900
2900	**Landscaping**				
2900	Site Development Excluded			1.00	
	Division 02 - Site Work Total				**42,003**
	Division 03 - Concrete				
3100	**Concrete Formwork**	**14569**	**smca**	**164.07**	**2,390,333**
3200	**Concrete Reinforcement**	**251120**	**kg**	**2.45**	**615,113**
3300	**Concrete Material & Placing**	**2642**	**m3**	**218.48**	**577,218**
3350	**Concrete Finishing**				**142,341**
3352	Steel Trowel Finish for Finish Floor	6221	m2	6.25	38,881
3352	Place/Finish Slab on Grade	981	m2	8.39	8,231
3352	Place/Finish Suspended Slabs	622	m2	8.39	5,215
3352	Place/Finish Slab on Grade	792	m2	8.39	6,646
3352	Place/Finish Suspended Slabs	5134	m2	8.39	43,055
3354	Plug & Patch Walls, Columns, & Beams	3629	m2	11.11	40,313
3400	**Pre-Cast Concrete**				**1,510**
3470	E/O Chamfer strip in concrete	302	lnm	5.00	1,510
3500	**Cementitious Decks and Toppings**				**25,450**
3500	Allowance for Concrete Sundries (Expansion Joints, Caulking etc,)	5090	m2	5.00	25,450
	Division 03 - Concrete Total				**3,751,965**
	Division 04 - Masonry				
4200	**Unit Masonry**				**537,820**
4210	Brick Veneer to exterior concrete walls (incl. blue skin, ties and related work)	462	m2	290.00	133,980
4210	Brick Veneer to interior concrete walls (incl. ties and related work)	663	m2	333.50	221,111
4220	6" Hollow Concrete Block Wall (and related support)	229	m2	129.17	29,642
4220	6" Hollow Concrete Block Wall	318	m2	129.17	41,108
4220	8" Hollow Concrete Block Wall	307	m2	168.20	51,647
4220	4" Hollow Concrete Block Wall	564	m2	107.00	60,332
	Division 04 - Masonry Total				**537,820**
	Division 05 - Metals				
5500	**Metal Fabrications**				**51,523**
5500	Partition Supports	290	each	67.50	19,575
5500	Trench Drain Grate & Frame	2	lnm	200.00	400
5500	In-lay foot grille (6' x 8')	2500	lsum	1.00	2,500
5515	Galvanized Roof Access Ladders	10	lnm	508.53	5,085
5515	Pit Ladders (5)	15	each	311.68	4,675
5520	Standard metal guardrail with glazing	12	lnm	300.00	3,690
5520	Metal Wall Rails Stairs	8	lnm	98.43	781
5520	Metal Guardrails	40	lnm	147.64	5,935
5520	Metal Wall Rails Stairs	25	lnm	98.43	2,431
5530	Steel Grating	15	m2	430.00	6,450
5700	**Ornamental Metal**				**12,961**
5700	Steel Pipe Railings (M&E)	12	lnm	492.13	5,906
5700	Architectural Metal Canopy Framing [Excl Glazing]	4	m2	1,614.59	7,056
	Division 05 - Metals Total				**64,484**
	Division 06 - Wood & Plastics				

CSI	Item Description	Quantity	Unit	Total Unit Price	Total
6100	**Rough Carpentry**				**11,631**
6111	Misc. Blocking @ radiant heating cabinets	302	lnm	15.07	4,552
6111	Misc. Blocking @ roof edge	215	lnm	15.07	3,241
6115	Plywood Exterior Sheathing 5/8"	229	m2	16.73	3,839
6200	**Finish Carpentry**				**65,640**
6200	Millwork Allowance (food service counter)	42	lnm	1,200.00	50,400
6200	Millwork Allowance (Base + upper cabinets)	10	lnm	984.00	9,840
6200	Millwork Allowance (Shelving)	11	lnm	300.00	3,300
6200	Millwork Allowance (counter)	6	lnm	350.00	2,100
	Division 06 - Wood & Plastics Total				**77,271**
	Division 07 - Thermal & Moisture Protection				
7100	**Waterproofing**				**29,225**
7100	Mirrian Drain At Basement Perimeter Walls	984	m2	22.07	21,713
7100	Waterproofing to Mech. Pits	1	each	1,000.00	1,000
7190	Poly Vapour Barrier 6 Mil	1774	m2	0.96	1,695
7195	39" Peel & Stick Blue Skin Membrane [Walls]	229	m2	20.99	4,817
7200	**Insulation**				**38,361**
7200	1/4" Reflective Insulating sheet [Radiant Heating]	229	m2	8.61	1,976
7212	Rigid Insulation - R5 1" (25mm)	229	m2	14.77	3,390
7220	Styrofoam 1" R5 [RSI 0.9] Rigid Insulation	1708	m2	13.70	23,392
7220	Insulation Overlay 1/2" Fibreboard	1708	m2	5.62	9,603
7460	**Siding**				**164,786**
7460	Metal Panels (Originally Porcelain Enamel Panels) on clips	356	m2	452.00	160,912
7460	Metal Panel System @ D/E link (with louvres)	9	m2	430.40	3,874
7500	**Membrane Roofing**				**119,419**
7500	Loose Laid Ballast to Roof Areas	1708	m2	16.10	27,495
7500	2 - Ply SBS Membrane Roofing	1708	m2	53.82	91,924
7600	**Flashing and Sheetmetal**				**6,450**
7600	Roof Flashing	215	lnm	30.00	6,450
7700	**Roof Specialties and Accessories**				**2,000**
7700	Roof Hatches	2	each	1,000.00	2,000
7800	**Skylights**				**3,293**
7800	Glazing to Steel Frame Canopies	4	m2	753.47	3,293
7900	**Joint Sealers**				**5,002**
7920	Sealants and Caulking Allowance @ metal panels	356	m2	14.05	5,002
	Division 07 - Thermal & Moisture Protection Total				**368,535**
	Division 08 - Door & Window				
8100	**Metal Doors and Frames**				**6,916**
8115	Hollow Metal Door Flush Panel 18ga 3-0x7-0	1	each	170.00	170
8115	Hollow Metal Doors Placed	1	each	20.00	20
8115	Hollow Metal Door Flush Panel 18ga 3-0x7-0	8	each	200.00	1,600
8115	Hollow Metal Doors Placed	8	each	20.00	160
8120	Hollow Metal Frames Install	15	each	85.93	1,289
8120	Hollow Metal Frame 16ga 3-0x7-0	1	each	121.00	121
8120	Hollow Metal Frames Install	1	each	85.93	86
8120	Hollow Metal Frame 16ga 3-0x7-0	8	each	121.00	968
8120	Hollow Metal Frames Install	8	each	85.93	687
8120	Hollow Metal Frame 16ga 3-0x7-0	15	each	121.00	1,815
8200	**Wood Doors - Solid Core**				**6,056**
8200	Install Solid Core Door & Hardware	15	each	53.71	806
8204	Single SC Door 3-0x7-0	15	each	350.00	5,250
8300	**Special Doors**				**2,500**
8305	Access Panel (Inspection hatch in GWB ceiling)	5	each	500.00	2,500
8400	**Entrances and Storefronts**				**18,532**
8410	Aluminum Interior Glazing at Main Entrance (Meekinson Lounge)	41	m2	452.00	18,532
8500	**Windows**				**20,336**
8520	Aluminum Windows - Plate glass @ D/E link	32	m2	645.60	20,336
8700	**Hardware**				**15,468**
8710	Kickplate - Stainless 10"x34"	15	pair	65.58	984
8710	Panic Bar	1	each	835.93	836
8710	Kickplate - Stainless 10"x34"	8	pair	65.58	525

CSI	Item Description	Quantity	Unit	Total Unit Price	Total
8715	Hinges	36	pair	47.58	1,713
8720	Lock Set	15	each	271.48	4,072
8720	Lock Set	8	each	271.48	2,172
8725	Door Closer	15	each	183.18	2,748
8725	Door Closer	9	each	183.18	1,649
8730	Threshold	15	each	33.48	502
8730	Threshold	8	each	33.48	268
8800	**Glazing**				**2,073**
8824	Mirror Wall (3) 5.5m x 1.0m	17	m2	65.00	1,073
8824	Mirrors 24" x 36"	4	each	250.00	1,000
8850	**Glazed Screens**				**40,951**
8852	Interior Glazed Partition, Single Clear Tempered Glass (Meekinson Lounge)	60	m2	376.60	22,596
8852	E/O Single Door Hardware to Interior Glazed Screen	8	each	1,000.00	8,000
8852	E/O Double Door Hardware to Interior Glazed Screen	2	each	1,600.00	3,200
8852	Clearstory Glazing, Single Clear Glass (Meekinson Lounge)	19	m2	376.60	7,155
8900	**Glazed Curtain Walls**				**220,291**
8920	e/o for Double Doors/Hardware	3	pair	1,600.00	4,800
8920	E/O Automatic Single Doors/Hardware	1	each	3,250.00	3,250
8920	Curtain Wall - Kawneer 1600 Series (Meekinson Lounge)	263	m2	807.00	212,241
	Division 08 - Door & Window Total				**333,123**
	Division 09 - Finishes				
9100	**Metal Support Systems**				**38,590**
9120	2' x 2' Acoustic T-bar ceiling	542	m2	71.20	38,590
9200	**Lath and Plaster**				**81,346**
9220	Stucco to soffit (u/s of level 2)	630	m2	129.12	81,346
9250	**Gypsum Board**	**3945**	**m2**	**44.71**	**176,398**
9300	**Tile**				**47,725**
9310	Ceramic Wall Tile to Washrooms	282	m2	91.50	25,803
9310	Ceramic Tile Base	116	lnm	32.80	3,805
9310	Ceramic Floor Tile to Washrooms	198	m2	91.50	18,117
9400	**Terrazzo**				**15,750**
9400	Terrazzo in main floor corridor	70	m2	225.00	15,750
9650	**Resilient Flooring**				**32,414**
9665	Linoleum Sheet Flooring	535	m2	51.13	27,355
9678	Resilient Base	617	lnm	8.20	5,059
9680	**Carpet**				**1,560**
9680	In-lay Carpet @ meeting rooms	29	m2	53.80	1,560
9900	**Painting**				**56,146**
9900	Painting - Doors & Frames	15	each	65.00	975
9900	Rolled Latex Based Paint 3 Coats - Walls	3425	m2	5.38	18,427
9900	Painting - Doors & Frames	9	each	65.00	585
9900	Rolled Latex Paint 3 Coats - Ceiling	1424	m2	5.92	8,427
9945	Clear Silicone (low-pressure Spray) over Masonry	462	m2	18.90	8,732
9945	Elastomerics & Mastics - Exterior Concrete walls	220	m2	26.90	5,918
9945	Elastomerics & Mastics - Exterior Concrete walls at D/E link	21	m2	26.90	551
9945	Clear Silicone (low-pressure Spray) over Interior Masonry	663	m2	18.90	12,531
	Division 09 - Finishes Total				**449,929**
	Division 10 - Specialties				
10150	**Compartments and Cubicles**				**27,720**
10160	Metal Toilet Partition	30	each	900.00	27,000
10160	Metal Urinal Screen	1	each	320.00	320
10185	Shower Cubicles	1	each	400.00	400
10400	**Identifying Devices**				**5,000**
10440	Interior Signs Allowance	1	lsum	5,000.00	5,000
10800	**Toilet and Bath Accessories**				**14,518**
10800	Grab Bar - Stainless Straight	1	each	96.74	97
10800	Grab Bar - Stainless Angular	1	each	86.48	86
10800	Soap Dish in shower	1	each	65.00	65
10800	Feminine Napkin Dispenser - flush mounted	23	each	40.00	920
10800	Robe Hooks	32	each	35.00	1,120
10800	Toilet Paper Holder	31	each	150.00	4,650

CSI	Item Description	Quantity	Unit	Total Unit Price	Total
10800	Hand Dryer	8	each	850.00	6,800
10800	Soap dispenser	8	each	50.00	400
10800	Seat (next to shower)	1	each	380.00	380
	Division 10 - Specialties Total				**47,238**
	Division 11 - Equipment				
11720	**Schools Equipment**				**3,500**
11722	Whiteboard 8' x 4'	2	each	750.00	1,500
11722	Tack surface on a pivoting panel	2	each	1,000.00	2,000
	Division 11 - Equipment Total				**3,500**
	Division 12 - Furniture				
12500	**Window Treatment**				**34,487**
12510	Horizontal PVC Blinds (Classrooms)	594	m2	53.82	31,969
12520	Roller Shades (Meekinson)	39	m2	64.56	2,518
12600	**Furniture and Accessories**				
12600	Meekinson Lounge Benches NIC		each		
	Division 12 - Furniture Total				**34,487**
	Division 13 - Special Construction				
1000	**General Conditions**				
1020	Allowances		lsum	1.00	
	Division 13 - Special Construction Total				
	Division 14 - Conveying System				
1000	**General Conditions**				
1020	Allowances		lsum	1.00	
	Division 14 - Conveying System Total				
	Division 15 - Mechanical				
15300	**Fire Protection**				**26,550**
15400	**Plumbing**				**250,300**
15500	**HVAC**				**585,680**
15950	**Controls**				**74,400**
	Division 15 - Mechanical Total				**936,930**
	Division 16 - Electrical				
16400	**Service and Distribution**				**37,500**
16500	**Lighting**				**89,575**
16600	**Special Systems**				**35,130**
	Division 16 - Electrical Total				**162,205**
	Grand Total	5090	m2	1,337.82	6,809,491

APPENDIX 3

Mechanical and Electrical Estimate Breakdown

UBC - Buchanan - Building D (Replacement Cost) **Job No. #26792**

Description	Trade	Quantity	Rate	Amount
C1 MECHANICAL				
	Total GFA	**4,913 m2**		
C11 Plumbing & Drainage				
Equipment				
PRV and water meter		ls		0
incoming steam pipework - modifications to remaining		ls		10,000
miscellaneous control valves, etc		ls		10,000
buffer storage tanks - 300 gallons		0 no	10,000.00	N/A
electric storage tanks - ??? gallons - Building E		0 no	5,000.00	N/A
remove existing storage tank		ls		N/A
domestic water heat-exchanger		0 no	15,000.00	N/A
expansion tank		0 no	1,500.00	N/A
re-circulation pump - replace existing		0 no	2,500.00	N/A
storm/sanitary sump pumps and ejectors		0 no	10,000.00	N/A
elevator sump pump		0 no	3,500.00	N/A
footing drain sump & backwater valve		ls		N/A
(Subtotal Equipment $20000)				
Piping				
dom' water mains & san' pipework upgrades - minimal		ls		75,000
domestic pipework mod's to basement & level 1		ls		35,000
hot & cold water branch pipework & sanitary connections to new plumbing fixtures		88 no	450.00	39,600
sanitary drainage to waterless urinals		0 no	1,000.00	Included
hot water recirculation		0 m	60.00	Included
specialist pipework systems		ls		N/A
sanitary drainage		0 m	85.00	Included
vent pipework		0 m	45.00	Included
storm drainage - minor modifications to remaining		ls		20,000
pipework connections to food services		ls		N/A
strip-out existing plumbing fixtures pipework - mod's		ls		N/A
strip-out existing redundant pipework - modifications		ls		N/A
domestic pipework replacement cost - allowance		4,913 m2	0.00	Included
(Subtotal Piping $169600)				

UBC - Buchanan - Building D (Replacement Cost) **Job No.** **#26792**

Description	Trade		Quantity	Rate	Amount
Fixtures					
floor drains			5 no	250.00	1,250
water closet - dual-flush	18810	570	33 no	650.00	21,450
water closet - H/C - dual-flush	02720	680	4 no	700.00	2,800
water closet - staff - dual-flush	0	0	0 no	600.00	0
lavatory	13330	430	31 no	550.00	17,050
lavatory - H/C	02650	530	5 no	650.00	3,250
lavatory - staff	0	330	0 no	450.00	0
urinal - waterless	06800	680	10 no	800.00	8,000
individual shower	01880	1880	1 no	2,000.00	2,000
janitor sink	01260	630	2 no	750.00	1,500
kitchen sink	0530	530	1 no	650.00	650
mixing valve			1 no	1,500.00	1,500
wall hydrant			0 no	250.00	0
rough-in dishwasher / washing machine			0 no	200.00	0
deck drains			0 no	250.00	0
drinking fountain	0	1305	0 no	1,425.00	Excluded
roof drains			5 no	250.00	1,250
miscellaneous allowance - kitchen			ls		0
strip-out existing plumbing fixtures			87 no	100.00	N/A
(Subtotal Fixtures $60700)	47980				
Total C11 Plumbing & Drainage			**4,913 m2**	**50.95**	**250,300**

UBC - Buchanan - Building D (Replacement Cost) **Job No. #26792**

Description	Trade	Quantity	Rate	Amount
C12 Fire Protection				
sprinkler valve station		ls		0
siamese connection		0 no	1,500.00	0
connection to Building E		ls		0
fire & jockey pump		0 no	25,000.00	0
full sprinkler and stand-pipe coverage to basement & level 1		78 no	225.00	17,550
penetration allowance		ls		0
stand-pipe coverage		0 no	10,000.00	0
connections to existing pipework c/w capping		0 no	1,000.00	0
fire hose cabinets		6 no	1,000.00	6,000
fire extinguishers		6 no	250.00	1,500
existing sprinkler removal		ls		1,500
Total C12 Fire Protection		**4,913 m2**	**5.40**	**26,550**
C13 HVAC				
Air Handling				
existing air-handling equipment		ls		50,000
level 1 HVAC upgrades (hatched area allowance)		583 m2	160.00	93,280
dedicated HRV (heat-recovery) unit		0 no	35,000.00	N/A
dedicated A/C to server rooms		0 no	25,000.00	N/A
associated circulating pumps		0 no	1,500.00	N/A
supply fan, filters, etc SF-D1 - 43,036cfm		0 no	30,000.00	N/A
return fan RF-A - 37,300cfm		0 no	10,000.00	N/A
exhaust fan EF-1 - 4,452cfm		0 no	5,500.00	N/A
miscellaneous exhaust fans - remaining		ls		10,000
smoke exhaust fans - allowance		ls		0
fluid-cooler & cooling tower		0 no	35,000.00	N/A
associated circulating pumps		0 no	3,500.00	N/A
chemical treatment (pot and feeders)		ls		N/A
glycol tank (1 looped system)		ls		N/A
expansion tank		ls		N/A
strip-out existing AHU's		0 no	2,000.00	N/A
remove existing heating coils		ls		N/A
remove existing exhaust fans		0 no	1,000.00	N/A
(Subtotal Air Handling $153280)				
Heating Plant				
heat-exchanger & associated plant - remaining equipment		ls		20,000
heat-exchanger connection for Bldg E		ls		N/A
re-circulation pump - replace existing		0 no	3,500.00	N/A
boiler breeching		ls		N/A
chemical treatment		ls		N/A
expansion tank		0 no	1,500.00	N/A
air-compressor equipment		ls		10,000
(Subtotal Heating Plant $30000)				

UBC - Buchanan - Building D (Replacement Cost) **Job No.** **#26792**

Description	Trade	Quantity	Rate	Amount
Piping				
natural gas		0 m	60.00	N/A
natural gas valves - shut-off		0 no	500.00	N/A
under-floor heating & chilled slab pipework		0 m2	30.00	N/A
under-floor heating & chilled slab monitors		0 no	1,000.00	N/A
hot water supply and return to perimeter radiation		1,400 m	75.00	105,000
supply & return heating pipework - heating coils		0 m	65.00	N/A
pipework connections to food services		ls		0
flush existing heating pipework system		ls		N/A
mechanical room pipework modifications - remaining pipe		ls		10,000
remove existing mechanical room pipework		ls		N/A
(Subtotal Piping $115000)				
Ductwork				
galvanized steel - mod's to existing main runs only		4,913 m2	30.53	150,000
air terminal grille		0 no	250.00	Included
diffusers, registers and grilles		ls		Included
clean existing remaining ductwork		ls		N/A
remove existing ductwork to mech room		ls		N/A
(Subtotal Ductwork $150000)				
Heating				
re-heat coils		0 no	2,500.00	N/A
re-heat coils		0 no	3,500.00	N/A
perim' radiation - new ceiling panels (excludes arch' enclosure)		350 m	300.00	105,000
clean existing perimeter radiation panels		0 m	40.00	N/A
VAV boxes to library space		0 no	850.00	N/A
convector heating units - store rooms		0 no	850.00	Included
unit heaters/entrance heaters/fan-coil heaters		2 no	1,200.00	2,400
strip-out existing perimeter radiation		310 m	37.04	N/A
(Subtotal Heating $107400)				
Test & commission/balancing, manuals, etc		ls		30,000
Total C13 HVAC		**4,913 m2**	**119.21**	**585,680**

UBC - Buchanan - Building D (Replacement Cost) **Job No. #26792**

Description	Trade	Quantity	Rate	Amount
C14 Controls				
Assume DDC controls on equipment only.				
computer software, etc		ls		10,000
air handlers / A/C unit - multi-zone		0 no	15,000.00	0
air handlers / A/C unit		3 no	6,000.00	18,000
dedicated A/C to server rooms		0 no	1,500.00	0
re-heat coils		0 no	1,000.00	0
fans, etc		ls		2,500
classroom cabinet fans		0 no	950.00	0
unit heaters, etc		2 no	950.00	1,900
domestic heating plant		ls		N/A
heat-recovery unit		ls		N/A
heating & cooling exchanger plant controls		ls		N/A
associated circulating pumps, etc		0 no	750.00	0
perimeter radiation controls upgrade - danfoss		44 no	750.00	33,000
VAV boxes		0 no	950.00	0
thermostat control - other valves		0 no	750.00	0
wind-scoop control		0 no	950.00	0
CO2 detection (3no. per floor)		9 no	1,000.00	9,000
strip-out existing controls		ls		N/A
Total C14 Controls		**4,913 m2**	**15.14**	**74,400**
TOTAL C1 MECHANICAL		**4,913 m2**	**190.70**	**936,930**

UBC - Buchanan - Building D (Replacement Cost) **Job No.** **#26792**

Description	Trade	Quantity	Rate	Amount
D21 Mechanical Site Services				
Building Services				
mechanical site services - allowance		ls		0
water & fire hydrant and pipework		ls		0
sanitary drainage & connection		ls		0
storm drainage & connection		ls		0
site drainage		ls		0
gas service - connection		ls		0
(Subtotal Building Services $0)				
Total D21 Mechanical Site Services		**4,913 m2**	**0.00**	**0**
TOTAL C1 AND D21 MECHANICAL		**4,913 m2**	**190.70**	**936,930**

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UBC - Buchanan - Building D (Replacement Cost)

ELECTRICAL
DIVISION 16 **DATE:** **06-Jul-06**

Summary

C21 Service & distribution		$37,500
C22 Lighting, devices & heating		$89,575
C23 Systems & ancillaries		$35,130
D13 Electrical site services including connection charges		$26,900
Total division 16		$189,105

Electrical Summary

	Cost m2	
Distribution	$ 7.63	$37,500
Lighting	$ 15.09	$74,140
Site lighting	$ 2.42	$11,900
Power	$ 3.14	$15,435
Fire alarm	$ 1.65	$8,105
Telephone & data	$ 4.39	$21,545
Security	$ -	$0
Public address	$ 1.12	$5,480
Building hook-up only	$ 2.04	$10,000
B.C. Telephone charges - connection only	$ 1.02	$5,000
Total division 16	$ 38.49	$189,105

Altus Helyar #26792

UBC - Buchanan - Building D (Replacement Cost)

ELECTRICAL
DIVISION 16 **DATE:** **06-Jul-06**

Project Statistics

Total GFA (m2)	**4913**
New area	**0**
Renovation area	**4913**
Cost per sf base building excluding hydro charges	**$35.44**
Total Electrical	**$174,105**
Building hook-up only	**$10,000**
B.C. Telephone charges - connection only	**$5,000**
Total Div. 16	**$189,105**

Altus Helyar #26792

UBC - Buchanan - Building D (Replacement Cost)

ELECTRICAL
DIVISION 16 **DATE:** **06-Jul-06**

Distribution

4913 $7.63

QUANTITY	ITEM	UNIT RATE	COST
1	Permit & set-up	$ 10,000.00	$10,000
0	Unit sub-station - 750kVA	$100,000.00	$0
0	1,200Amp main CDP distribution panel	$ 30,000.00	$0
0	New breakers to existing equipment	$ 35,000.00	$0
10	100Amp distribution panel (includes panels for Bldg E)	$ 1,250.00	$12,500
0	Laboratory panel boards	$ 1,000.00	$0
0	Meter cabinets	$ 2,500.00	$0
0	Motor control centre	$ 5,000.00	$0
10	Feeders cables	$ 1,500.00	$15,000
0	Generator 50 KW / 185 KVA	$ 25,000.00	$0
0	Transfer switch 225 amp	$ 14,000.00	$0
0	B.C. Hydro & B.C. TEL incoming conduits	$ 5,000.00	$0
1	Strip-out existing redundant panels	$ 5,000.00	N/A
	TOTAL		**$37,500**

Altus Helyar **#26792**

UBC - Buchanan - Building D (Replacement Cost)

ELECTRICAL
DIVISION 16 **DATE:** **06-Jul-06**

Lighting

4913 $15.09

QUANTITY	ITEM	UNIT RATE	COST
24	Fixture type - Ref FG washroom ceiling	$ 85.00	$2,040
32	Fixture type - Ref FG - corridor / staircase	$ 100.00	$3,200
19	Exterior light fixture	$ 300.00	$5,700
1	Lamps	$ -	Included
56	Fixture installation	$ 30.00	$1,680
56	Conduit & wire	$ 120.00	$6,720
0	Stage lighting rack	$ 1,000.00	$0
0	Allow low voltage control system - general	$ 10,000.00	$0
0	Low voltage control system - theatres	$ 1,500.00	$0
0	Switches	$ 100.00	$0
0	Switches 3-way	$ 130.00	$0
0	Dimming light fixture premium	$ 26,500.00	Excluded
0	Occupancy sensors premium	$ 10,500.00	Excluded
0	Daylight sensors & dimming control premium	$ 16,000.00	Excluded
0	Relocate existing lighting & devices	$ 125.00	$0
75	Strip-out existing redundant lighting & devices	$ 25.00	N/A
320	Basement lighting requirements (cost per m2)	$ 40.00	$12,800
525	Level 1 lighting requirements (cost per m2)	$ 80.00	$42,000
	TOTAL		**$74,140**

Altus Helyar **#26792**

UBC - Buchanan - Building D (Replacement Cost)

ELECTRICAL
DIVISION 16 **DATE:** **06-Jul-06**

Site Lighting

QUANTITY	ITEM	UNIT RATE	COST
5	Fixture type - pole mounted	$ 2,000.00	$10,000
1	Fixture type P - bollards	$ 400.00	$400
0	Fixture type - step-light	$ 250.00	$0
0	Lamps	$ 15.00	$0
0	Lamps	$ 25.00	Included
1	P.S.T. on fittings and lamps	$ 1,300.00	Included
6	Conduit & wire	$ 250.00	$1,500
0	Sign power outlets	$ 250.00	N/A
0	Timeclock	$ 500.00	N/A
0	Photo-cell	$ 50.00	N/A
0	Contactor	$ 500.00	N/A
6	Remove existing light fixtures	$ 50.00	N/A
	TOTAL		**$11,900**

Altus Helyar **#26792**

UBC - Buchanan - Building D (Replacement Cost)

ELECTRICAL
DIVISION 16 **DATE:** **06-Jul-06**

Power

4913 $3.14

QUANTITY	ITEM	UNIT RATE	COST
1	Miscellaneous mechanical power supplies	$ 5,000.00	$5,000
320	Basement power requirements (cost per m2)	$ 8.00	$2,560
525	Level 1 power requirements (cost per m2)	$ 15.00	$7,875
	TOTAL		**$15,435**

Fire alarm

4913 $1.65

QUANTITY	ITEM	UNIT RATE	COST
0	Fire Alarm Panel - addressable	$ 5,000.00	$0
0	Annunicator panel	$ 1,500.00	$0
5	Bells/Gongs	$ 125.00	$625
4	Pull stations	$ 100.00	$400
0	Duct detectors	$ 150.00	$0
1	Smoke detectors	$ 100.00	$100
0	Heat detectors	$ 90.00	$0
0	Sprinkler valves	$ 100.00	$0
0	Fan shut down relays	$ 200.00	$0
10	Conduit & wire	$ 100.00	$1,000
1	Verification	$ 500.00	$500
320	Basement fire alarm requirements (cost per m2)	$ 4.00	$1,280
525	Level 1 fire alarm requirements (cost per m2)	$ 8.00	$4,200
	TOTAL		**$8,105**

Altus Helyar **#26792**

UBC - Buchanan - Building D (Replacement Cost)

ELECTRICAL
DIVISION 16 **DATE:** **06-Jul-06**

Telephone & data

4913 $4.39

QUANTITY	ITEM	UNIT RATE	COST
0	Telephone/data outlets	$ 50.00	$0
0	Telephone/data conduit & wiring	$ 300.00	$0
0	Telephone/data floor outlets	$ 75.00	$0
0	Telephone/data conduit & wiring	$ 350.00	$0
0	Plywood backboards	$ 100.00	$0
0	Back-bone cabling allowance	$ 45,000.00	$0
0	Comunication room equipment - allowance	$ 12,500.00	$0
205	L/Mtr. telephone tray - allowance	$ 65.00	$13,325
320	Basement tel/data requirements (cost per m2)	$ 6.00	$1,920
525	Level 1 tel/data requirements (cost per m2)	$ 12.00	$6,300
	TOTAL		**$21,545**

Security

4913 $0.00

QUANTITY	ITEM	UNIT RATE	COST
0	Cameras	$ 1,500.00	$0
0	VCR	$ 8,000.00	$0
0	Monitor	$ 1,200.00	$0
0	Multiplexer	$ 5,000.00	$0
0	Security equipment & wiring - allowance	$ 70,000.00	$0
0	Motion detectors	$ 100.00	$0
0	Door contacts	$ 75.00	$0
0	Siren	$ 200.00	$0
0	Key pad	$ 1,000.00	$0
0	Card reader	$ 2,500.00	$0
0	Conduit rough-in only	$ 26,500.00	Included
	TOTAL		**$0**

Altus Helyar **#26792**

UBC - Buchanan - Building D (Replacement Cost)

ELECTRICAL
DIVISION 16 **DATE:** **06-Jul-06**

Public address
4913 $1.12

QUANTITY	ITEM	UNIT RATE	COST
0	Head end equipment	$ 10,000.00	$0
320	Basement public address requirements (cost per m2)	$ 4.00	$1,280
525	Level 1 public address requirements (cost per m2)	$ 8.00	$4,200
	TOTAL		**$5,480**

Total **$174,105**

Altus Helyar #26792

UBC - Buchanan - Building D (Replacement Cost)

ELECTRICAL
DIVISION 16 **DATE:** **06-Jul-06**

Assumptions & exclusions

1 **Civil work excluded**
2 **Telephone & data cables are included**
3 **Electrical engineer has NOT reviewed the budget.**
4
5
6
7

Description

Incoming power service connected to the local hydro authority.
Lighting and power as per hydro code.
Fire alarm system provided.
Telephone conduit & wiring is included.
Security system rough-in included
Public address system is included.
UPS system is excluded

Altus Helyar #26792

UBC - Buchanan - Building D (Replacement Cost)

ELECTRICAL
DIVISION 16 **DATE:** **06-Jul-06**

High voltage

QUANTITY	ITEM	UNIT RATE	COST
0	High voltage switchgear sections	$ 12,000.00	$0
0	High voltage disconnects	$ 15,000.00	$0
0	Transformer 750 KVA	$ 30,000.00	$0
0	L/Ft. 3 - 3" Ducts	$ 18.00	$0
0	Pull boxes	$ 1,200.00	$0
0	Excavation, concrete & backfill		**See architectural**
0	Hydro charge	$ 10,000.00	$0
0	Add section to 600 volt switchboard	$ 5,000.00	$0
0	L/Ft. 4 #3/0 in 2" conduit	$ 18.00	$0
0	L/Ft. 3 #3/0 in 2" conduit	$ 16.00	$0
0	Connect into existing 150 KVA transformer	$ 1,000.00	$0
0	Allowance for miscellaneous connections	$ 6,320.00	$0
	TOTAL		**$0**

APPENDIX 4

Project Area Summary

Project : Buchanan Building D

Date : 10-Jul-06
Job No : 26792

Floor GFA m2	Levels	Classroom & Offices m2	Stair & Elev m2	Circulation m2	M & E / Storage m2	WC's m2	Total GFA m2	Girth m	Floor Height m	Exterior Wall Area m2
1,716	Level 3	1,184	60	392	18	62	1,716	210.00	3.35	704
1,702	Level 2	1,129	60	400	18	95	1,702	207.00	3.35	693
1,095	Level 1	778	60	214	18	25	1,095	180.00	3.81	686
4513	Above Grade Total	3,091	180	1006	54	182	4513	597.00	10.51	2,083
577	Basement	100		45	432		577	103.00	3.35	345
577	Below Grade Total	100	0	45	432	0	577	103	3.35	345.05
5,090	Total	3,191	180	1,051	486	182	5,090	700	14	2,428
5,090	x chk									

Total GFA 5,090 m2
Total GLA 5,090 m2

APPENDIX 5

Design Information

UBC BUCHANAN BLOCK D
SALVAGED VALUE ESTIMATE

This report is based on the documents [drawings] provided by Busby, Perkins + Will Architecture;

SCHEDULE OF DRAWINGS

Drawing #	Description	Issue Date
	Buchanan Block D 90% DD drawing set	
	Demolition Drawings by Busby, Perkins + Will received September 28, 2005	
D100	Demolition Plans: Block D Basement + Level 1	26-Sep-05
D101	Demolition Plans: Block D Level 2 + Level 3	26-Sep-05
	Architectural Drawings by Busby, Perkins + Will received Sept 28, 2005	
A000	Building Element Types	26-Sep-05
A001	Door Types + Window Types	26-Sep-05
A002	Finish Schedule + Door Schedule: Block D	26-Sep-05
A100	Floor Plans: Block D Basement + Level 1	26-Sep-05
A101	Floor Plans: Block D Level 2 + Level 3	26-Sep-05
A102	Floor Plan: Block D Roof Level	26-Sep-05
A300	Sections: Block D	26-Sep-05
A320	Elevations: Block D + Link	26-Sep-05
A400	Exterior Wall: Block D Levels 2+3 Existing & New	26-Sep-05
A500	Washrooms: Block D Plans, Typical Elevations	26-Sep-05
A600	Reflected Ceiling Plans: Block D Basement + Level 1	26-Sep-05
A601	Reflected Ceiling Plans: Block D Level 2 + Level 3	26-Sep-05
A700	Block D West Stair + Exterior Stairs	26-Sep-05
A701	Block D East Stair	26-Sep-05
A702	Block D Elevator	26-Sep-05
G-000	Cover page and Drawing Index: Block D	26-Sep-05
	Structural Drawings Prepared by Fast + Epp Structural Engineers received September 28, 2005	
S1	General Notes	26-Sep-05
S2	Level 1 + Level 2 Plans	26-Sep-05
S3	Level 3 + Roof Plan	26-Sep-05
S4	Sections, Details + Corridor Wall Elevations	26-Sep-05
S5	Sections and Details	26-Sep-05

UBC BUCHANAN BLOCK D
SALVAGED VALUE ESTIMATE

Mechanical Drawings by Keen Engineering received September 28, 2005

M000	Site Plan Block D	26-Sep-05
M001	Floor Plans: Block D Basement + Level 1 - Demo	26-Sep-05
M002	Floor Plans: Block D Level 2 + Level 3 - Demo	26-Sep-05
M100	Floor Plans: Block D Basement + Level 1 - HVAC	26-Sep-05
M101	Floor Plans: Block D Level 2 + Level 3 - HVAC	26-Sep-05
M102	Floor Plans: Block D Mechanical Room - HVAC	26-Sep-05
M200	Mechanical Schematic: Block D	26-Sep-05
M201	Air Schematic and details: Block D	26-Sep-05

Plumbing Drawings by Keen Engineering received September 28, 2005

P100	Floor Plans: Block D Basement + Level 1-Plbg	26-Sep-05
P101	Floor Plans: Block D Level 2 + Level 3-plbg	26-Sep-05
P102	Washroom groups Block D	26-Sep-05
F100	Floor Plans: Block D Basement + Level 1-Fire	26-Sep-05
F101	Floor Plans: Block D Level 2 + Level 3 - Fire	26-Sep-05
F200	Fire Protection Schematic: Block D	26-Sep-05

Electrical & Technology Drawings by Acumen Consulting Engineers received September 28, 2005

E0.00	Site Plan	26-Sep-05
E0.01	One Line Diagram	26-Sep-05
E4.00	Building 'D' Basement Plan	26-Sep-05
E4.01	Building 'D' Level 1 Plan	26-Sep-05
E4.02a	Building 'D' Level 2 Plan	26-Sep-05
E4.02b	Building 'D' Level 2 Plan	26-Sep-05
E4.03a	Building 'D' Level 3 Plan	26-Sep-05
E4.03b	Building 'D' Level 3 Plan	26-Sep-05
E5.00	Classroom Layout	26-Sep-05
E5.01	Classroom Layout	26-Sep-05
E5.02	Classroom Layout	26-Sep-05
E5.07	Sections and Elevations	26-Sep-05
E5.08	Conduit Riser Diagram	26-Sep-05
T4.00	Building D Basement Plan	26-Sep-05
T4.01	Building D Level 1 Plan	26-Sep-05
T4.02	Building D Level 2 Plan	26-Sep-05
T4.03	Building D Level 3 Plan	26-Sep-05

Landscape Drawings by Busby, Perkins + Will received September 28, 2005

G-L050	Key Plan: Site	24-Aug-05

UBC BUCHANAN BLOCK D
SALVAGED VALUE ESTIMATE

Drawing #	Description	Issue Date
	Buchanan Block D as built drawings (1959, 2001, 2002)	
	Architectural Drawings by Thompson, Berwick & Pratt Architects received June 15, 2005	
A2	Basement Plan	Jul-59
A3	Main Floor and Arcade Plan	Jul-59
A4	Second Floor Plan	Jul-59
A5	Third Floor Plan	Jul-59
A8	Roof Plan and Door Schedule	Jul-59
A9	Elevations	Jul-59
A11	Elevations and sections	Jul-59
A12	Cross sections	Jul-59
A14	Stair Section and details	Jul-59
A17	Link and Bridge window detail	Jul-59
	Structural Drawings by O. Safir & CO. Ltd. received June 15, 2005	
SP1	Foundation and Basement Plan	Jul-59
SP2	Column and Walls schedule	Jul-59
SP3	Main Floor Plan	Jul-59
SP4	Second Floor Plan	Jul-59
SP5	Third Floor Plan	Jul-59
SP6	Roof Plan	Jul-59
SP7	Main Link Stairs	Jul-59
	Mechanical Drawings by D.W.Thomson & Company Ltd. Mechanical Engineers received July 4, 2006	
P-1	Site Plan and Details	Jul-59
P-2	Roof and Basement Floor Plan	Jul-59
P-3	Main Floor Plan	Jul-59
P-4	Second Floor Plan	Jul-59
P-5	Third Floor Plan	Jul-59
P-6	Main Floor Plan (office plan)	Jul-59
M-1	Basement Heating Plan	Jul-59
M-3	Second Heating Plan	Jul-59
M-4	Third Heating Plan	Jul-59
M-5	Mechanical Heating Plan	Jul-59
M-6	Mechanical Heating Sections	Jul-59

UBC BUCHANAN BLOCK D
SALVAGED VALUE ESTIMATE

Mechanical Drawings by Stantec received July 4, 2006

M-1	Main Floor Plan	Jun-02
M-2	Schedule and Schematic	Jun-02

Electrical Drawings by Simpson & McGregor Electrical Engineers received June 30, 2006

E-1	Site Plan	Jul-59
E-2	Basement Plan	Jul-59
E-3	Arcade Level	Jul-59
E-4	Second Level	Jul-59
E-5	Third Level	Jul-59
E-6	Main & Second Floor	Jul-59

Meekison Lounge Architectural Drawings by Marceau Evans Architects received July 05, 2006

A.03	Main Floor Plan	Sep-01
A.04	Reflected Ceiling Plan	Sep-01
A.05	Section A,B and C	Sep-01
A.06	Section D and E	Sep-01
A.07	Section F and G	Sep-01
A.08	Interior Elevations	Sep-01
A.09	Millwork Elevations + Sections	Sep-01
A.10	Millwork Elevations + Sections	Sep-01
A.11	Interior Elevations	Sep-01
A.12	Interior Elevations	Sep-01

APPENDIX 6

Outline Specifications and Assumptions

UBC BUCHANAN BLOCK D
SALVAGED VALUE ESTIMATE

ASSUMPTIONS/ESTIMATE GUILDELINES

Substructure

- Perimeter Drainage included
- Site work has been measured separately (not part of the environmental analysis)

Structure

Most of the structure is being preserved in the renovation process. Below are the structure assumptions;

- 30MPa for all concrete
- All measurements for foundations and structures based on O. Safir & Co. Ltd's drawings dated July 17, 1959 except 8" suspended slabs and roof slabs instead of 12 ½" voided slabs
- Footing/ beam excavation measured from level of the lowest floor slabs
- 4"/ 5"/ 6" Slabs on grade as per structural drawings
- 8" suspended slabs and 8" roof slab instead of using voided slabs as mentioned above
- 6"/ 8"/ 10" wall below grade as per structural drawings
- All walls above grade to be 8" thick
- Concrete material prices based on local supplier
- Forming and placing priced at $15.25/sfca
- Rebar is priced at $1.05 /lb based on local market

Envelope

- The Glazing was removed throughout the building except at the Meekison Lounge located on the ground floor and at the Block D/E link. The Meekison Lounge was an addition to the building in 2001. The enclosing walls were priced as Curtain walls (Kawneer 1600 series) as shown on the drawings. The Block D/E link glazing was priced as aluminum framed plate glass.
- The Porcelain Enamel Panels on the North and South face were preserved through the renovations and therefore included in the estimate as Alucobond Panels since the original panels has been discontinued.
- The remaining walls above grade are a combination of painted concrete and glazed brick veneer attached to the concrete walls.
- The radiant heating cabinet on the inside face of the exterior walls was preserved.
- Caulking, blocking and misc. work untouched by the demolition phase were also included.
- The original Built-up roof is being kept along with the blocking and flashing. The roofing system rest on 25mm (1" thick) Lightweight Concrete Fill.
- Steel and glazed canopy and guardrail to the Meekison Lounge entrance are the "remaining" projections after demolition.
- Stucco to the soffits

UBC BUCHANAN BLOCK D
SALVAGED VALUE ESTIMATE

Finishes, Fitting and Equipment

This section mostly apply to the untouched area of the building; Basement area, Meekison Lounge and Washrooms.

- The Meekison Lounge partitions were included as drywall and steel studs or glazed as per drawings. The remaining partitions are a combination of 4"/ 6" / 8" concrete block.
- Fire rated hollow metal doors to exit stairs and service rooms. Solid Core wood doors to the washrooms.
- Floor finishes were preserved in the basement (linoleum), the Meekison Lounge (in-lay carpet and polished concrete), the main level corridor (terrazzo) and to the washrooms (ceramic tile). The finishes are applied on a 25mm concrete topping (100mm at the Main level).
- Some suspended drywall ceiling is remaining in the washrooms. The Meekison Lounge ceiling is a combination of Drywall and 2' x 2' acoustic tile.
- Ceramic tile to the washroom walls, clear silicone coating to the masonry walls and rolled latex paint to the remaining walls.
- Fitting & Fixtures consist of the metal fabrication items, washroom accessories, toilet partitions, mirrors, millwork items and blinds.
- Whiteboards and Tackboards in the Meekison Lounge.

Services

Mechanical

- Plumbing and drainage; Pipework and miscellaneous control valves within existing mechanical room. Washroom plumbing fixtures and connections to pipework
- Main pipework and branch work to main level washrooms
- Sprinklers to basement and level 1
- HVAC and controls; Perimeter radiation and associated controls are included. Existing air handling unit and heat exchangers remaining

Electrical

- Remaining secondary distribution panels
- Basement and level 1 lighting& power included
- Exterior light fixtures
- Basement & level 1 fire alarm, data and public address system

Site Development

- Excluded for this exercise

UBC BUCHANAN BLOCK D
SALVAGED VALUE ESTIMATE

GENERAL REQUIREMENTS

- Assumed 7% of overall budget. This is intended to cover all items that would be included in the General Requirements division, including; general labour, construction safety officer, site foremen, quality control and quality requirements, temporary utilities and facilities, cranes, cleaning, fences and hoarding, miscellaneous tools, cartage, equipment rentals, garbage disposal, surveys etc.

PROFIT/FEE

- Assumed 5% of overall budget

APPENDIX 7

Standard Exclusions / Qualifications Policy

UBC BUCHANAN BLOCK D
SALVAGED VALUE ESTIMATE

EXCLUSIONS

- Owners financing, legal and administrative costs
- Project Management Fees
- Survey Fees
- Marketing and/or advertising Fees
- Acoustical treatment and equivalency
- Municipal Taxes & Levies
- Development Cost Charges
- Development Permit Fees
- Building Permit Fees
- Encroachment and air rights agreements
- City assessments/charges for off-site service upgrades
- Utility company assessments/charges for off-site service upgrades
- Hydro charges and primary building power supply cable excluded
- Traffic signals and off site services
- Performance and L&M Payment Bonds
- Course of Construction & Wrap-Up Liability insurance
- Costs associated with unsuitable soils
- Excavation in rock unless otherwise noted
- Escalation
- Demolition and alterations of existing buildings unless otherwise noted
- Removal and disposal of underground tanks
- Hazardous materials abatement, specifically asbestos and contaminated soils
- Audio, visual and other loose equipment and furnishings unless otherwise noted
- Advertising - Logo signage
- Costs associated with an accelerated construction schedule requiring shift work
- GST

QUALIFICATIONS

- The estimate(s) for construction cost contained in this report represent Altus Helyar's professional opinion of a fair and reasonable cost for the work based upon the information provided and the condition of the market place as determined by Altus Helyar at the time of preparing this report.
- The estimate(s) do not constitute an offer to undertake the work, nor is any guarantee given that and offer to undertake the work at the estimated costs will subsequently be submitted by a construction contractor.
- Unless explicitly stated otherwise, the estimate(s) are based on a competitive tendering situation with a minimum of 4 qualified Contractors bidding all scopes of work of the project.
- This report is intended solely for the use of the client within the context of the contract for professional services between the client and Altus Helyar, and shall not create any liability to any person or body not specifically stated as being a party to that contract.